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# WEST CRANE SPRINKLER IRRIGATION PROJECT

# DRAFT ENVIRONMENTAL ASSESSMENT

**Prepared by**

**MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION**

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NOTICE - FEBRUARY 8, 1999

The Department of Natural Resources and Conservation has completed its draft environmental assessment (EA) for the West Crane Sprinkler Irrigation Project. Copies of the draft EA are being circulated for public review. A public meeting will be held at the Sidney Public Library on Monday, February 22, 1999 at 7:00 p.m to answer questions on the EA and to receive written and oral comments. Written comments also will be accepted prior to the public meeting. They should be addressed to:

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Or comments can be emailed to: ldolan@mt.gov

The draft EA for the West Crane Sprinkler Irrigation Project was prepared pursuant to the Montana Environmental Policy Act, and Montana Water Use Act. Additional copies of the draft EA can be obtained by calling Larry Dolan at (406) 444-6627, or by writing DNRC at the address listed above.

Jack Stults
Water Resources Division Administrator
Department of Natural Resources and Conservation

**1.0 - PURPOSE AND NEED FOR ACTION** ..... 1

1.1 PROJECT LOCATION ..... 1
1.2 BACKGROUND ..... 5
1.3 HISTORY ..... 5
1.4 SCOPE OF THE ENVIRONMENTAL ANALYSIS ..... 5
*Public Involvement* ..... 6
*Agency Involvement* ..... 6
*Issues Studied in Detail* ..... 6
1.7 APPLICABLE REGULATORY REQUIREMENTS ..... 7
*Richland County Conservation District (RCCD)* ..... 7
*Montana Department of Natural Resources and Conservation (DNRC)* ..... 7
*U.S. Army Corps of Engineers (COE)* ..... 7
*US Fish and Wildlife Service (USFWS)* ..... 7
*Montana Department of Fish, Wildlife and Parks (DFWP)* ..... 7
*Montana Department of Environmental Quality (DEQ)* ..... 7

**2.0 - ALTERNATIVES INCLUDING THE PROPOSED ACTION** ..... 9

2.1 DEVELOPMENT OF ALTERNATIVES ..... 9
*Primary Issue* ..... 9
*Other Relevant Issues* ..... 9
2.2 DESCRIPTION OF ALTERNATIVES ..... 10
*Alternative 1 - No Action* ..... 10
*Alternative 2 - Proposed Project* ..... 10
*Alternative 3- Fine Screening of Intakes* ..... 12
*Alternative 4 - Infiltration Gallery* ..... 13
*Alternative 5 – Slotted HDPE pipe intake screens with Bendway weirs.* ..... 14

**3.0 - AFFECTED ENVIRONMENT** ..... 16

3.1 LAND USE AND VEGETATION ..... 16
*Sensitive Plants* ..... 16
*Noxious Weeds* ..... 17
*Land Ownership* ..... 17
*Transportation* ..... 17
3.2 WETLANDS ..... 18
3.3 WATER RESOURCES ..... 19
*Surface Water* ..... 19
*Water Quality* ..... 19
Total Dissolved Solids (TDS) ..... 20
*Sodium Adsorption Ration (SAR)* ..... 21
Sodium, Chloride, and Boron ..... 22
Arsenic ..... 22
Total Suspended Sediment (TSS) ..... 22
Temperature ..... 22
Dissolved Oxygen ..... 23
Suitability of Water for Irrigation ..... 23
*Stream Channel Form* ..... 23
3.4 GROUND WATER ..... 26
*Hydrogeologic Units* ..... 26
*Ground Water Flow and Ground Water Quality* ..... 28
3.5 SOILS ..... 31
3.6 ECONOMIC AND SOCIAL FACTORS ..... 33
*Population* ..... 33
*Employment* ..... 33

*Income* ..... *33*
*Taxation* ..... *34*
*Agricultural Sales* ..... *34*
3.7 WILDLIFE ..... 34
3.8 FISHERIES ..... 36
3.9 CULTURAL RESOURCES ..... 38
3.10 RECREATION ..... 38
*Yellowstone River* ..... *38*
*Gartside Reservoir* ..... *39*

**4.0 - ENVIRONMENTAL CONSEQUENCES ..... 40**

4.1 LAND USE AND VEGETATION ..... 40
*Vegetation* ..... *40*
*Sensitive Plants* ..... *40*
*Land Use* ..... *40*
*Power transmission lines* ..... *40*
*Highways, Railroads, Canals* ..... *41*
*Transportation* ..... *41*
4.2 WETLANDS ..... 41
*Impacts* ..... *41*
4.3 WATER RESOURCES ..... 42
*Surface Water* ..... *42*
*Water Quality* ..... *44*
Total Suspended Sediment ..... 44
Total Dissolved Solids ..... 44
Temperature and Dissolved Oxygen ..... 45
Arsenic ..... 45
*Stream Channel Form* ..... *45*
4.4 GROUND WATER ..... 46
4.5 EFFECTS ON SOILS ..... 48
*Soils Impacts Due to Irrigation* ..... *48*
*Erosion* ..... *48*
*Salinity* ..... *49*
*Soils Impacts Due to Converting from Dryland Agriculture to Irrigated Agriculture* ..... *52*
*Soils Impacts Due to Converting Rangeland to Irrigated Agriculture* ..... *52*
*Soils Impacts Due to Pipeline and Service Road Construction* ..... *52*
4.6 ECONOMIC AND SOCIAL FACTORS ..... 53
*Population* ..... *53*
Effects of No Action ..... 53
Effects of Project under the Four Action Alternatives ..... 53
*Employment and Income* ..... *53*
Effects of No Action ..... 53
Effects of Project under the Four Action Alternatives ..... 53
*Taxation* ..... *54*
Effects of No Action ..... 54
Effects of Project under the Four Action Alternatives ..... 54
*Agricultural Sales* ..... *54*
Effects of No Action ..... 54
Effects of Project under the Four Action Alternatives ..... 54
4.7 WILDLIFE ..... 54
4.8 FISHERIES ..... 55
*General Comments and Concerns* ..... *55*
Alternative 1- No Action ..... 55
Alternative 2- Proposed Project ..... 55
Alternative 3- Fine Screening of Intakes ..... 56
Alternative 4- Infiltration Gallery ..... 56
Alternative 5 – Slotted HDPE Pipe with Bendway Weirs ..... 56
4.9 CULTURAL RESOURCES ..... 56

4.10 RECREATION ..... 57
*Yellowstone River* ..... *57*
Gartside Reservoir ..... 57

**5.0 – PREFERRED ALTERNATIVE AND RECOMMENDED MITIGATION MEASURES ..... 58**

5.1 PREFERED ALTERNATIVE ..... 58
5.2 RECOMMENDED MITIGATION ..... 58
*Fisheries* ..... *58*
*Water Quality* ..... *58*
*Recreation* ..... *59*
5.3 NEED FOR AN EIS ..... 59

**6.0 - REFFERENCES ..... 61**

**7.0 - LIST OF PREPARERS ..... 65**

# List of Acronyms

COE ..... U.S. Army Corps of Engineers

DEQ ..... Montana Department of Environmental Quality

DFWP ..... Montana Department of Fish, Wildlife, and Parks

DNRC..... Montana Department of Natural Resources and Conservation

DO..... Dissolved Oxygen

EA ..... Environmental Assessment

EIS ..... Environmental Impact Statement

ET ..... Evapotranspiration

MEPA..... Montana Environmental Policy Act

NEPA ..... National Environmental Policy Act

NRCS..... Natural Resource Conservation Service

NRHP..... National Register of Historic Places

PCPI..... Per Capita Personal Income

RCCD..... Richland County Conservation District

TDS..... Total Dissolved Solids

TPI ..... Total Personal Income

TSS..... Total Suspended Sediment

USFWS..... U.S. Fish and Wildlife Service

USGS..... U.S. Geological Survey

WCSIP ..... West Crane Sprinkler Irrigation Project

WCSIP, LLC..... West Crane Sprinkler Irrigation Project Limited Liability Company

# 1.0 - PURPOSE AND NEED FOR ACTION

The purpose of the West Crane Sprinkler Irrigation Project (WCSIP) is the irrigation of 11,965 acres of land in Richland County, Montana. The project sponsor, the West Crane Sprinkler Irrigation Project Limited Liability Company (WCSIP,LLC), believes the project is needed to improve farm economic viability and to provide economic benefit to the surrounding area. To provide the necessary water for the project, the Richland County Conservation District (RCCD) is seeking authorization from DNRC, on behalf of WCSIP,LLC, to develop 23,930 acre-feet of reserved water from the Yellowstone River, at a maximum rate of 132.5 cubic feet per second (cfs), through a water right change application.

The following Draft Environmental Assessment (EA) is an examination of the potential effects of development of the WCSIP. The Draft EA has been prepared by the Montana Department of Natural Resources and Conservation (DNRC) to comply with the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA). If impacts of the proposed project are found to be insignificant or can be adequately mitigated, the EA will be deemed the appropriate level of environmental review. If impacts of the proposed project are found to be significant, and proposed mitigation inadequate or of questionable merit, the applicants will be required to prepare an environmental impact statement (EIS). Written comments on the Draft EA must be provided by the date specified by the notice accompanying this report.

## 1.1 Project Location

The proposed project is located in southeast Richland County near Sidney, Montana. Figure 1.2-1 shows the project location. Water would be diverted directly from the Yellowstone River at a point 12 miles south of Sidney, near Crane (Figure 1.2-2). Approximately 78 miles of pipeline would be necessary to convey water for irrigation of lands located as far as 15 miles west of the point of diversion (Figure 1.2-3).

Figure 1-2-1. Location Map For West Crane Sprinkler Irrigation Project.

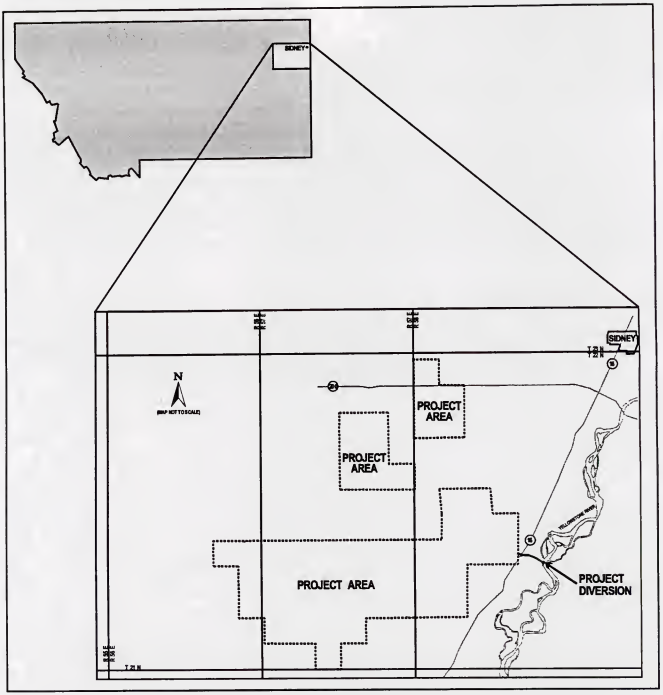


Figure 1.2-2: Location Of Proposed Diversion Site For West Crane Sprinkler Irrigation Project.

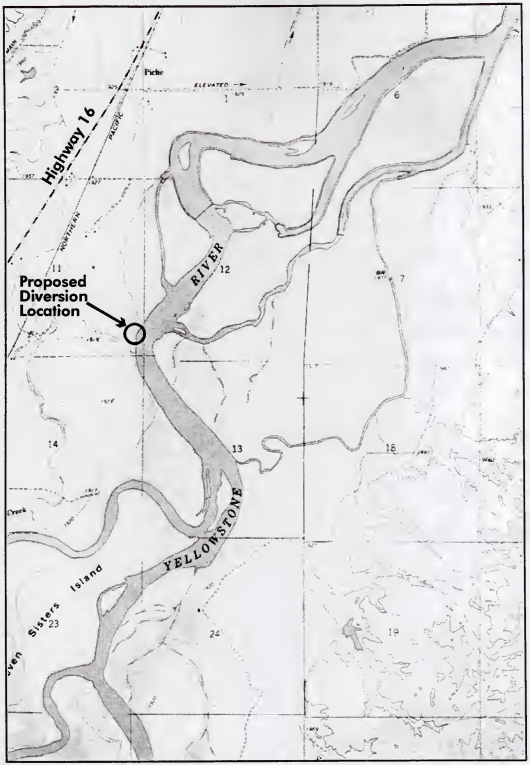
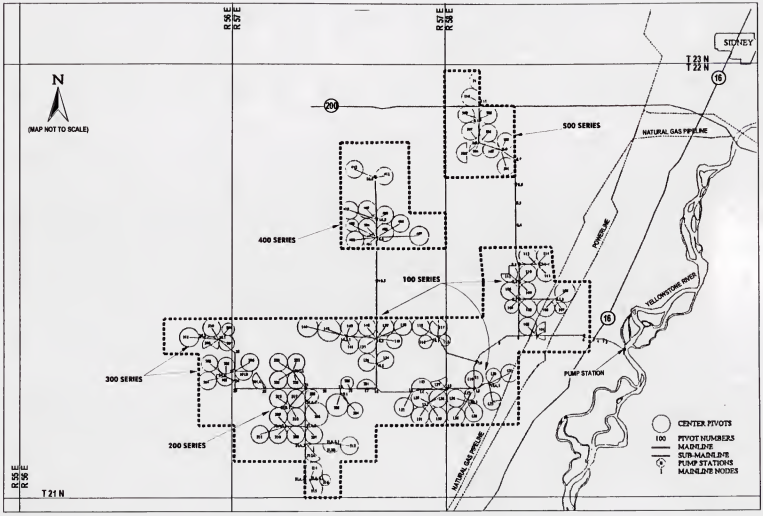


Figure 1.2-3. Pivot And Pipeline Locations For The West Crane Sprinkler Irrigation Project.



## 1.2 Background

WCSIP, LLC, the project proponent, is a limited liability company with plans to become an Irrigation District with full taxation authority. It has approximately 24 member families and is operated by an eight-person board of directors. WCSIP, LLC began as an independent association of family farmers formed to examine the feasibility of using sprinkler irrigation on local lands presently cultivated using dry-land farming methods.

The project has evolved in response to heightened local interest in raising diverse high value crops, and the economic opportunities presented as a result of changing crop rotation strategies in the area. Land ownership of the proposed project area is primarily private. Some of the landowners farm their own land while others lease their ground. There are a few sections of State School Trust land owned by the State of Montana in the project area.

## 1.3 History

The Water Use Act of 1973 made it possible for public entities, such as the State of Montana and the conservation districts, to reserve water for existing or future consumptive uses, while maintaining a minimum required flow level and quality of water. To reserve water, a qualified public body, such as the RCCD, must apply to DNRC to establish their reservation.

In the years prior to 1974, a substantial number of applications for water use permits for drawing large amounts of water from the Yellowstone River were received by DNRC. Many of these applications requested significant amounts of water for energy-related industrial development. In 1974, the Montana Legislature instituted a moratorium which suspended all applications for water use permits for large diversions within the Yellowstone Basin in response to concerns that industrial water development would occur at the expense of municipal, agricultural, and instream water use development.

The moratorium allowed local, state, and federal agencies, such as the RCCD, to assess their future water requirements and submit reservation applications. During this period, the state, pursuant to MEPA, conducted an environmental review of the proposed reservations which determined the amount of water available for allocation and quantified instream flow requirements for the Yellowstone River (DNRC, 1976).

RCCD holds a reserved water right, with a priority date of December 15, 1978, as a result of the reservation process. The WCSIP proposal calls for the use of about half of the 1978 reserved water right. The water right authorizes a total appropriation of not more than 45,620 acre-feet per year to irrigate 21,710 acres located within the RCCD.

WCSIP, LLC, first submitted an application for a Reserved Water Use Authorization to the RCCD on January 14, 1998, but then modified this application and resubmitted it on September 1, 1998. It included a variance to allow for an increase in water distribution distance exceeding five miles, west of the Yellowstone River. The RCCD is required to file an Authorization to Change their water right with DNRC because the proposed diversion point and irrigated lands were not identified in the RCCD's original water reservation. If approved, the change authorization would allow the RCCD to include the WCSIP, LLC's point of diversion and place of use within their reserved water right.

## 1.4 Scope of the Environmental Analysis

An Environmental Impact Statement (EIS) was prepared in 1976 (DNRC 1976) to address proposed water reservations in the Yellowstone River basin. The 1976 EIS was comprehensive and examined the project-specific and combined cumulative impacts of all the proposed water reservations. Water was reserved for the RCCD to irrigate specific parcels of land that were identified in its water reservation application and subject to the original EIS review. Of the 11,965 acres which the WCSIP,LLC proposes to develop for irrigation, about 2,440 acres (about 20 percent) were identified in the original RCCD water reservation application.

Because the WCSIP is quite different from the projects originally proposed by the RCCD, this EA is necessary so that the site-specific impacts associated with the project can be assessed. It does not address the "cumulative" impacts of large-scale irrigation development on the environment of the Yellowstone River basin because these impacts were addressed in the 1976 Yellowstone Basin Water Reservations EIS.

The scope of the EA has been established assuming that the laws and regulations relative to water appropriation and environmental standards are valid and that the lands proposed for irrigation under the project are consistent with local development plans. This section of the EA summarizes the process used to identify relevant issues raised by the proposed project. Documentation for this process is on file at DNRC in Helena.

## Public Involvement

A public meeting was held at the Sidney Public Library on August 6, 1998, to gather public comment on the proposed project and the process used to develop the EA. The meeting was conducted by DNRC in collaboration with the U.S. Army Corps of Engineers (COE). Approximately 30 members of the local community attended. Representatives from DNRC and the COE gave presentations regarding agency involvement in the environmental review process. Project representatives gave a brief description of the WCSIP. Interested persons were encouraged to comment orally at the meeting or in writing.

## Agency Involvement

An agency scoping meeting was held at the Lower Yellowstone Rural Electric Cooperative offices in Sidney on August 6, 1998 to discuss the project applications and identify potential environmental issues. Agency representatives from DNRC, Montana Department of Fish, Wildlife and Parks (DFWP), the COE and the RCCD, as well a project representative, attended the meeting.

## Issues Studied in Detail

The issues to be examined in detail in this EA were dictated by an interpretation of the proposed action and technical concerns by the agencies involved, as well as concerns raised through comments received from the public and commenting agencies. Listed below are potential project-related effects examined in this document:

- Effects on Threatened or Endangered Fish Species, and Species of Special Concern, such as the pallid sturgeon, sicklefin chub, sturgeon chub, paddlefish, blue sucker, sauger, and burbot, due to entrainment of eggs or larva into the irrigation pump intakes and stream flow reductions.
- Effects of agricultural chemical use, such as pesticides, herbicides and fertilizers, on local ground and surface water quality due to irrigation water seepage and return flows.
- Effects on Wetlands and Waters of the U.S. resulting from project construction including bank stabilization at the point of diversion, installation of the water distribution pipelines, roads and transmission lines, and development of individual center pivot sprinkler systems.
- Effects of Increased Soil Erosion due to project construction and the application of irrigation water to soil types susceptible to erosion.
- Effects on Wildlife from project development, particularly lights, noise and activity related to operation and maintenance of the diversion pumps adjacent to the Seven Sisters Wildlife Management Area.
- Effects on the Local Economy and Government Services resulting from development of the proposed project.
- Effects on Historic and Prehistoric Cultural Resources due to construction of 78 miles of underground pipeline and the cultivation of approximately 760 acres of previously uncultivated land.

- Effects on Vegetation and Land Use due to the conversion of dry-land farming acreage to irrigated acreage.

## 1.7 Applicable Regulatory Requirements

### Richland County Conservation District (RCCD)

- 310 Permit: Work on the Yellowstone River diversion station, and pipeline and road crossings over the North Fork of Fox Creek and Fox Creek--which are considered to be perennial streams--would require authorization under the Montana Natural Streambed and Land Preservation Act (310 permit). The permit can be obtained through application to the RCCD.

- Authorization to use reserved water – The WCSIP applicants requires authorization from the RCCD to use the water proposed for the project.

### Montana Department of Natural Resources and Conservation (DNRC)

- Water Rights Bureau - Authorization to change point of diversion for use of reserved water right.

- State Lands Easement – Where pipelines and power line right-of-way corridors cross state-owned lands.

- Floodplain Development Permit – This permit is required because the diversion station and pipeline would be constructed within the 100-year floodplain of the Yellowstone River.

### U.S. Army Corps of Engineers (COE)

- Section 10 of Rivers and Harbors Act – for construction activities in the Yellowstone River, a federally listed navigable water.

- Section 404 of Clean Water Act: - Irrigation intakes and delivery canals are generally exempted from Section 404 permitting requirements.

- Compliance with the National Historic Preservation Act.

### US Fish and Wildlife Service (USFWS)

- Endangered Species Act: Compliance and Consultation

### Montana Department of Fish, Wildlife and Parks (DFWP)

- Non-game and Endangered Species Conservation Act: 87-5-101 - "Species or subspecies of wildlife indigenous to this state which may be found to be endangered within the state should be protected in order to maintain and to the extent possible enhance their numbers"

- The Natural Streambed and Land Preservation Act of 1975: 75-7-101 (310 Permit) – DFWP works as a team with the conservation district to determine whether the project is reasonable, and whether there are alternative solutions that would reduce disturbance to the stream and effects on fish and aquatic habitat.

### Montana Department of Environmental Quality (DEQ)

- 3A Authorization: Construction of the project pump station and related bank stabilization would likely increase suspended sediment and turbidity to levels above established standards under all of the action alternatives. Therefore, a short-term exemption from surface water quality standards (3A authorization) from the Montana DEQ would be needed before project construction, including pipeline crossings over tributary streams, could commence.

- MPDES Permit: If construction of the diversion system would require dewatering pumping, a Montana Pollutant Discharge Elimination System Permit (MPDES) would be required from DEQ. This permit would be required for the Infiltration Gallery Alternative (Alternative 4) because water within the construction cofferdam would need to be pumped out during construction.

- Storm Water Discharge: A Storm Water Discharge Permit, issued by DEQ, may be required during construction of the diversion station and during construction of pipeline crossings under all of the action alternatives.

# 2.0 - ALTERNATIVES INCLUDING THE PROPOSED ACTION

This chapter describes, in detail, the *No Action Alternative*, the *Proposed Project* (i.e., the sprinkler irrigation project proposed by West Crane, LLC), and other reasonable alternatives that were studied. In addition, this chapter presents a comparative summary of the beneficial and adverse environmental effects of the alternatives based on information and analysis presented in Chapter 3.0 - *Affected Environment*, and Chapter 4.0 - *Environmental Consequences*. This chapter also describes and summarizes how issues identified during the scoping process were used to develop alternatives to the proposed project.

## 2.1 Development of Alternatives

There are countless possible variations or alternatives to any proposed action. However, the purpose of developing project alternatives is to address issues or potential problems raised by the proposed project. In addition to the No Action and the Proposed Project, three other alternatives, known as the *Fine Screening of Intakes Alternative, Infiltration Gallery Alternative*, and *Slotted HDPE Pipe intake screens with Bendway Weirs Alternative* have been developed to address the primary environmental issue raised by this project.

### Primary Issue

The primary issue that has emerged through the agency and public scoping process is the potential effect the proposed project may have on fish in the lower Yellowstone River, especially the endangered pallid sturgeon. A potential exists for the diversion pump intakes to entrain the larvae and fry of various fish species, increasing fish mortality rates. Pump operation, as proposed, may negatively affect the endangered pallid sturgeon, the blue sucker and paddlefish (species of special concern), as well as shovelnose sturgeon, sauger, walleye, and other fish larvae by direct water withdrawal from the Yellowstone River. The pump intakes may also negatively affect "minnow species," such as the sturgeon chub and sicklefin chub (species of special concern). It is these fisheries concerns that have resulted in the development of the *Fine Screening of Intakes Alternative,* the *Infiltration Gallery Alternative, and the Slotted HDPE Pipe intake screens with Bendway Weirs Alternative* (see Description of Alternatives) as potential modifications to the proposed project.

### Other Relevant Issues

As identified in Chapter 1.0, other relevant issues are raised by the proposed project. These include potential effects to wetlands, erodible soils, water quality and quantity, wildlife, bank stabilization, cultural resources, and social and economic considerations. While these issues have not resulted in development of additional alternatives, the effect of each alternative on these individual resource areas is examined and compared in the succeeding chapters.

## 2.2 Description of Alternatives

### Alternative 1 - No Action

The *No Action Alternative* serves as a baseline description for current conditions at the project site. Under *No Action*, the reservation application submitted by WCSIP, LLC and the diversion change application submitted by the RCCD would *not* be approved, and the WCSIP would not be developed. The current conditions at the project site would continue unaffected by further irrigation development. See Chapter 3.0 - *Affected Environment*, for a detailed profile of the current environmental situation in the project area.

Currently, most of the proposed project acreage is used for either dry-land farming or as pasture. The main crops are spring wheat, winter wheat, barley, oats, corn for silage, grass hay, and alfalfa hay. Production of these crops would likely continue under the *No Action Alternative*. Other higher value crops such as malting barley, corn, sugar beets, potatoes, onions, carrots, and peas could not be grown without irrigation on the lands proposed.

Potential effects to endangered fish species would not occur under the *No Action Alternative* because no water would be diverted from the Yellowstone River. Effects related to development of the other project components, such as the water distribution system and irrigation pivots would not occur. No new local jobs would be created and no additional property tax revenues would occur as a result of the conversion of dry-land acres to irrigated acres. The sale of electricity necessary to power the project would not occur.

### Alternative 2 - Proposed Project

The proposed project involves diverting up to 23,930 acre-feet of water per year by pumping up to 132.5 cubic feet per second of water from the Yellowstone River to supply 103 center pivots irrigating 11,965 acres. There are four primary project components: 1) the diversion pump station, 2) the water distribution system, 3) the power distribution system, and 4) the irrigation pivots.

**Diversion Pump Station** - Figure 2.2-1 is a photograph of the proposed diversion pump site. Figure 2.2-2 shows a typical floating pump configuration. The proposed configuration of the river pump station calls for a total of fifteen floating pumps: twelve 200 horsepower pumps (5,000 gallons per minute (gpm) each); two 125 horsepower (3,000 gpm each); and one 60 horsepower (1,500) gpm). The reason for the number of pumps is the limited capacity of the individual pumps. The pump intakes would be screened to keep out trash and some fish, but the mesh size has not been identified.

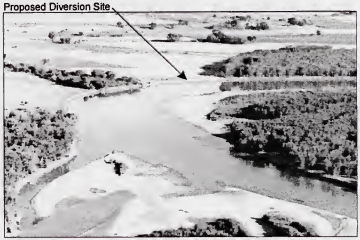



Figure 2.2-1. Photograph of the proposed pump site for the West Crane Sprinkler Irrigation Project

River bed and bank disturbance would occur along 450 feet of the river. Figure 2.2-3 shows a typical bank section. Figure 2.2-4 depicts the bank stabilization measures proposed by the applicant. Grading would be required to establish a uniform bank slope and a layer of rock would be placed to protect the bank from erosion. The estimated excavation will be 650 cubic yards, all of which would be used to establish a smooth, uniform bank slope. An estimated 1,700 cubic yards of rock will be needed to construct the three-foot thick rock rip-rap layer, consisting of rocks no more than two feet in diameter.

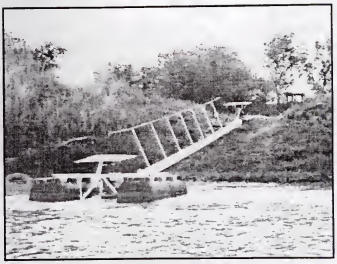


Figure 2.2-2. A Floating Centrifugal Pump

**Water Distribution System** - The total length of underground pipeline necessary to convey water to the pivots is 78 miles. Twenty-six of these miles would consist of pipe greater than 18 inches in diameter, with the remainder being less than 18 inches. A network of mainlines would supply cluster points from which laterals or sub-mainlines would lead to each center pivot. To maintain the necessary water pressure, booster pumps would be installed in the distribution system.

The pipeline system is shown in Figure 1.2-3. The mainline would proceed west from the diversion pump station and cross under four rights-of-way:

Burlington Northern- Santa Fe Railroad;

State Highway 16;

U.S. Bureau of Reclamation - Lower Yellowstone Irrigation Project Canal; and

Montana-Dakota Utilities - Williston Basin Natural Gas Pipeline.

Figure 2.2-3. Yellowstone River Bank at Proposed Diversion Site

No surface disturbance is expected within any of these corridors. The mainline would be placed below the surface right-of-ways. The remainder of the mainlines would roughly follow section lines to manifolds where water would be distributed to the center pivots.

**Power Distribution System** - Electricity would be supplied to power the center pivots as well as the pump stations. This power would be supplied through overhead utility transmission lines. Underground transmission lines may be required for some sections. The electricity to run the pivots would be carried through secondary cables buried in the same trench as are the water supply laterals. At least one substation would be constructed, but its location has not yet been determined.

**Center Pivots** - As a rule, quarter-mile (1,300 feet long) pivots would be used. In a few instances, longer pivots would be used. All center pivots would be powered by electrical motors. For center pivot irrigation, no land leveling would be required. Preparation required would include moving fence lines, breaking-out acres that are not being cultivated, bridging the bottoms of a few coulees with dikes to provide center pivot wheel tracks, and establishing grassed waterways in the bottoms of small channels that will run through a small number of fields. In addition, a basic system of permanent farm roads would need to be developed to access pump stations and pivots.

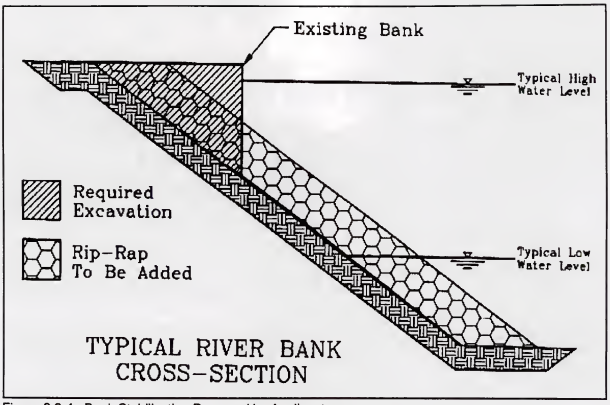



Figure 2.2-4. Bank Stabilization Proposed by Applicant

## Alternative 3- Fine Screening of Intakes

This alternative was developed to address concerns regarding the entrainment and impingement of fish. The system would require about fifteen 4,000 gpm, floating pumps, with a self-cleaning screen installed on the intake flange of each pump. The pump screens would be constructed of 22-gage wire cloth woven to 8 meshes per inch. The resulting opening size would be about 2.5 mm (.097 inches). DFWP has recommended a screen size opening of no greater than 2.5 mm (0.1 inch) to exclude most eggs and 5.0 mm (0.2 inches) for larvae and juvenile fish. To preclude the impingement of fish, the screens would be designed so that screen intake velocities would not exceed 0.5 feet per second. Given the required flow and a screen open area of 60 percent, each screen would have to have a surface area of about 17.7 square feet. Figure 2.2-5 depicts an example of a self-cleaning screen.

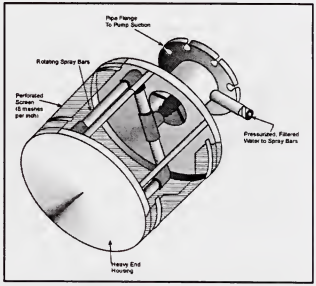



Figure 2.2-5. Generalized Drawing of a Self-Cleaning, Fine-Meshed Pump Screen

Assuming a diameter of 2 feet--which is typical--the required length of the screen (top to bottom) would be about 2.8 feet. An internal baffling arrangement would be used in the screens to balance intake velocities over the screen area. A self-cleaning mechanism consisting of a series of internal rotating nozzles would spray water at pressures of 20 to 100 pounds per square inch (psi) from inside the screen to push trash away from the screen face. About 150 gpm of flow would be used to clean the screen for each pump. The screening would add about $30,000 to initial construction costs, and about $40,000 to annual maintenance and electrical costs.

This alternative would include no bank stabilization. The river will continue to migrate into the meander bend and will probably create a vertical bank each season. If bank stabilization is not undertaken, permanent facilities, e.g., manifolds, valves, transformers and electrical control, lighting, etc., should be placed far enough (at least 500 feet) from the existing bank to provide a reasonable life.

This alternative does not change the water diversion system from that proposed by the applicant. The water and power distribution system and sprinkler layout would be the same as described in Alternative 2.

## Alternative 4 - Infiltration Gallery

This alternative also was developed to address fish entrainment and impingement concerns by modifying a primary component of the proposed project: the means by which water is diverted from the Yellowstone River. Instead of using floating pumps, water would be diverted from the river using an infiltration gallery consisting of a network of perforated pipe laid horizontally and packed in gravel below the bed of the river. Water would infiltrate downward from the river by gravity, through the gravel pack, and into the perforated pipe. From there it would flow through collector pipes into sumps located a short distance back from the river bank. Water would be pumped from these sumps to the pipeline distribution system. Fish fry and larvae would be excluded from the system by virtue of the fact that the actual point of diversion would be beneath the river's bed. Due to the large surface area of the infiltration gallery, approach velocities from the river bed into the gallery would be negligible. Figure 2.2-6 is a general sketch for this type of system.

To construct the infiltration gallery, a portion of the river bed would have to be dewatered temporarily. This could be done by constructing a coffer dam around the construction area and then pumping the water out. Excavation to about five feet below the river bed would be required. A network of collector pipes would then be laid horizontally in the excavated area and the entire area would then be back-filled with gravel and the coffer dam removed. Bank stabilization measures would be similar to the proposed project: approximately 500 feet of rock rip-rap would be required.

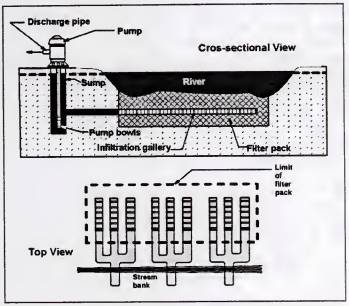


Figure 2.2-6. General Infiltration Gallery Schematic

An infiltration gallery, approximately 500 feet by 60 feet, would be required to supply adequate water for the project. About 50, 14-inch diameter, 50-foot long sections of perforated pipe would be used. To keep fine-grained river sediments from permeating into the gravel pack and reducing inflows, the infiltration gallery would require periodic back-washing. This would be accomplished by back-washing each of the 50 lines for 10-15 minutes in rotation every 10 to 12 hours.

This alternative changes only the water diversion system from that which is proposed by the applicant. The water and power distribution system, and center pivot layout would be the same as described in Alternative 2. Construction of an infiltration gallery may add $250,000 to $500,000, up front, to the total project cost.

## Alternative 5 – Slotted HDPE pipe intake screens with Bendway weirs.

An alternative way to divert water from the river while minimizing impacts to fish would be by using slotted high density polyethylene (HDPE) pipe as an intake screen. Under this option, bendway weirs also would be used as an alternative to rip-rap as a bank stabilization measure. The weirs would be placed on the river bend at 200 to 300 foot spacings (see Figure 2.2-7). To control the migration of the Yellowstone River meander bend in the vicinity of the project, weirs also would need to extend along the river bank up to about 1,500 feet south and 750 feet north of the proposed pump site (see figure 2.2-7). The top of the bendway weirs would be below the water surface except during times when river flows are very low. A scour hole would likely develop at the downstream end of each weir, which would provide the flow depth needed for pumping.

The weirs also would provide hydraulic properties, such as sweeping velocities, that would be necessary to keep this passive screening system from plugging. The HDPE pipe would be slotted with the 2.5 mm (.1 inch) openings, the opening size identified by DFWP to address fisheries concerns. The HDPE pipe would extend through the weir and float downstream of the weir tip. Because HDPE pipe is less dense than water, it would be necessary to weight or anchor the intake pipe to keep it about 1 foot beneath the surface of the water at all times. Eighteen-inch diameter pipe would be used to keep velocities in the pipe at or below 5 feet per second. About 30 feet of pipe would be needed at each weir.

The HDPE screens would be directed by pipe to centrifugal pumps on shore, or a series of vertical turbine pumps in sumps, or to submersible pumps installed in the slope of the stream bank. The HDPE screening would add about $72,500 to initial construction costs, and should have about the same annual maintenance and electrical costs as Alternative 2. The weirs would cost about $100,000. This cost may be similar to that of the rip rap bank stabilization proposed by the applicant. More details on this alternative and alternatives 3 and 4 can be found in a report prepared by Aquoneering (1998).

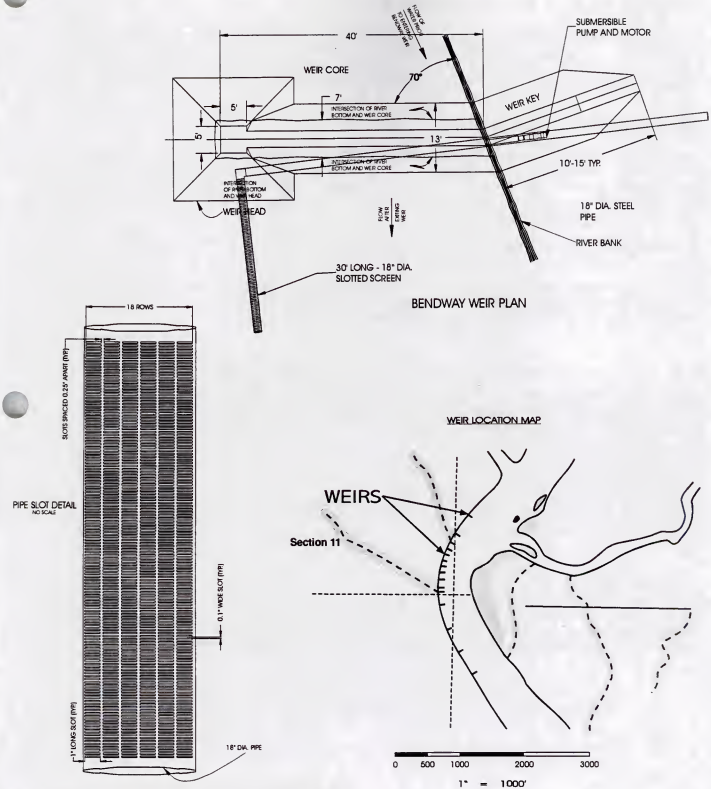



Figure 2.2-7 Conceptual Design for Alternative 5

# 3.0 - AFFECTED ENVIRONMENT

To evaluate potential impacts resulting from the proposed project and the other alternatives described in Chapter 2.0, it is necessary to understand the current environmental condition of the project area. The evaluation area for this project varies with each resource, but generally, it is the area proposed for irrigation. The concerns identified previously in Chapter 1.0 form the basis for the following descriptions.

## 3.1 Land Use and Vegetation

The WCSIP would irrigate upland benches adjacent to the Yellowstone River, and the main supply pipeline would cross the west-side of the Yellowstone River Valley. Most of the land that is proposed to be irrigated is cropland (93 percent), with the remainder being range and a few parcels of land that are in the Conservation Reserve Program (CRP). The existing type of vegetation on lands where irrigation is proposed is summarized in Table 3.1-1.

Primary crops grown in the project area include spring wheat, winter wheat, barley, oats, and hay. Grain crops are often grown in rotation with a season of fallow.

Typical rangeland vegetation in the project area includes native grasses such as western wheatgrass, little bluestem, green needlegrass, thick-spike wheatgrass and needle-and-thread, and introduced grasses such as smooth brome and Kentucky bluegrass; and shrubs and forbes.

Table 3.1-1. Existing vegetation and land use on acres to be irrigated by the WCSIP.

| Vegetation/Land Use | Acres | Percent of Total |
|---|---|---|
| Cropland | 11,112 | 93 percent |
| Rangeland | 760 | 6% |
| Conservation Reserve Program (CRP) | 61 | <1% |
| Farm Yards | 9 | <1% |

### Sensitive Plants

Some types of plants in Montana are declining in both number and distribution. The Montana Natural Heritage Program has identified rare Montana plants so resource managers can assess the potential effects of development on these plants. Table 3.1-2 lists sensitive plant species that occur in Richland County. None of these plants are listed as threatened or endangered under the Endangered Species Act.

Table 3.1-2. Sensitive plants that are known to occur in Richland County.

| Scientific Name | Common Name | State Rank | Habitat |
|---|---|---|---|
| **Bidens Comosa** | Beggar-ticks | S1 | moist areas near streams and ponds |
| **Dalea Enneandra** | Nine-anther prairie clover | S1 | gravelly, open soil on slopes |
| **Lobelia Spicata** | Palespike lobelia | SH | prairies and meadows |
| **Solidago Ptarmicoides** | Prairie Aster | S1 | prairies |

S1: Critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factor of its biology, making it especially vulnerable to extinction.

SH: Historically known, may be rediscovered.

Source: Montana National Heritage Program.

## Noxious Weeds

Noxious weeds are undesirable plants that can infest cropland and have little or no value as forage for livestock and wildlife. Because most noxious weeds were introduced to this continent from elsewhere, they have few natural enemies here and therefore can spread rapidly and out-compete native plants if not controlled. Disturbed land, such as fallow fields, and corridors for roads, pipelines, and transmission lines, are particularly susceptible to weed infestations.

The Montana Department of Agriculture has designated 15 plants as noxious weeds. Noxious weeds that are serious problems in the project area include Canada thistle (Cirsium arvense), Russian knapweed (Centaurea repens), and field bindweed (Convolvulus arvensis).

## Land Ownership

The lands to be irrigated are 100 percent privately owned. Pipeline and transmission line routes usually traverse private lands, but also cross over state and federally owned parcels in a few cases. The proposed right-of-way for the main power transmission line would cross a section of state-owned land. Other pipeline and transmission line routes would follow state land boundaries. In two instances, pipeline / transmission line routes would follow the boundaries of two small parcels of federal lands administered by the U.S. Bureau of Land Management. The proposed pipeline and transmission line routes generally follow existing roads.

The main supply pipeline for the WCSIP would be bored under the Lower Yellowstone Irrigation District supply canal. The canal and adjoining right-of-way are owned by the U.S. Bureau of Reclamation. The main pipeline would cross the right-of-way for the Williston Basin Natural Gas Pipeline.

## Transportation

State Highways 16 and 200 are the two paved roads within the project area. Many other improved and unimproved roads traverse the area. These roads generally receive light traffic, with some of the improved roads being maintained by Richland County. The main water supply pipeline for the project would be bored under State Highway 16 and the adjacent Burlington Northern Santa Fe Rail Line. A small pipeline would cross under State Highway 200 to supply water to two irrigation center-pivots in the northern unit of the project.

## 3.2 Wetlands

Scattered pothole-type wetlands exist throughout the proposed project area. In addition, pipelines would cross small streams, such as Crane, Fox, and North Fork of Fox creeks, which have adjoining wetlands and moist riparian areas.

A preliminary determination of wetlands within the project area was conducted by the NRCS using five years of color aerial photographic slides, draft National Wetland Inventory Maps, infra-red photo-maps, soils information, and information from a previous wetlands inventory. The results of this analysis are summarized in Tables 3.2-1 and 3.2-2. Thirty-nine potential wetlands comprising 17 acres of land were identified within the proposed irrigated field boundaries. Most of these wetlands are seasonally flooded and generally do not contain water year-round. A few wetlands are within moist stream channel zones. Thirty of the potential wetlands, comprising 11 acres, are currently farmed. The remaining nine wetlands, comprising six acres, are located on range-lands.

Wetlands also occur along proposed pipeline and road routes (Table 3.2-2), especially at stream crossings.

Table 3.2-1. Wetlands Within the Boundaries of Fields that Would be Irrigated by the WCSIP.

| Pivot ID | Number of Wetlands | Acres | Existing Land Use |
|---|---|---|---|
| 103 | 2 | .9 | Range |
| 106 | 1 | .3 | Range |
| 108 | 2 | 0.6 | Crop |
| 113 | 1 | 1.1 | Crop |
| 117 | 2 | 0.4 | Crop |
| 118 | 1 | 0.3 | Crop |
| 120 | 1 | Channel | Range |
| 128 | 1 | 0.3 | Crop |
| 129 | 1 | .2 | Crop |
| 130 | 1 | .2 | Crop |
| 138 | 3 | 1 | Crop |
| 139 | 2 | 0.5 | Crop |
| 203 | 1 | .4 | Crop |
| 206 | 2 | .8 | Crop |
| 207 | 1 | .2 | Crop |
| 208 | 1 | .2 | Crop |
| 209 | 2 | .2 | Crop |
| 214 | 1 | 0.7 | Crop |
| 217 | 1 | .2 | Crop |
| 218 | 1 | .1 | Crop |
| 221 | 1 | .7 | Crop |
| 303 | 1 | Channel | Crop |
| 305 | 1 | Channel | Crop |
| 309 | 1 | Channel | Range |
| 310 | 1 | Channel | Range |
| 404 | 1 | .2 | Crop |
| 406 | 1 | .9 | Crop |
| 408 | 1 | 1.1 | Crop |
| 412 | 1 | 5 | Range |
| 507 | 1 | .2 | Crop |
| 509 | 1 | .4 | Crop |

Table 3.2-2. Locations Where Project Pipelines or Powerlines Would Cross Wetlands.

| Location | Comments |
|---|---|
| Sec. 10, T21N, R58E | |
| Sec. 8, T21N, R58E | |
| Sec. 18, T21N, R58E | |
| Sec. 28, T22N , R58E | Crosses Fox Creek |
| Sec. 21, T22N, R58E | Crosses N.F. Fox Creek |
| Sec. 2 & 35, T21N, R57E | Crosses Fox Creek |
| Sec. 12,13,11,&14, T21N, R56E | Crosses Crane Creek at several places |
| Sec. 11, T21N, R58E | Main pipeline near diversion point. |
| Sec. 15, T21N, R58E | Powerline crosses Crane Creek |

## 3.3 Water Resources

### Surface Water

Streamflows at the project area are summarized as monthly percentile flows for the U.S. Geological Survey (USGS) streamflow gauge No. 6329500, *Yellowstone River near Sidney* in Table 3.3-1. Percentile streamflows are the flow rates that have been equaled or exceeded at a given frequency over the period of record. For example, during August, for the period of record 1933-1996, the Q80 (80th percentile) flow for the Yellowstone River is 4,730 cfs and the Q20 (20th percentile) flow is 10,583 cfs. This means that the average monthly flow was greater than 4,730 cfs during 51 of the 64 Augusts (80 percent of the time) from 1933-1996. Similarly, only 13 of the 64 Augusts (20 percent) between those years had monthly average flows of 10,583 cfs or more. The Q80 and Q90 streamflows presented in Table 3.3-1 characterize streamflows during drier years. Conversely, the Q10 and Q20 streamflows are representative of those that would occur during wet years. Average conditions are represented by the Q50, (50th percentile), or median flow. Median monthly flows for the *Yellowstone River near Sidney* gauge are graphed in Figure 3.3-1.

Keep in mind that the flows presented are average monthly flows and, at times, flows in the river will drop lower. For example, the lowest monthly average flow on record for the *Yellowstone River near Sidney* was 1,602 cfs, which occurred during August of 1961. In comparison, the lowest seven-day average minimum flow on record for the *Yellowstone River near Sidney* was 1,010 cfs, which also occurred during August of 1961.

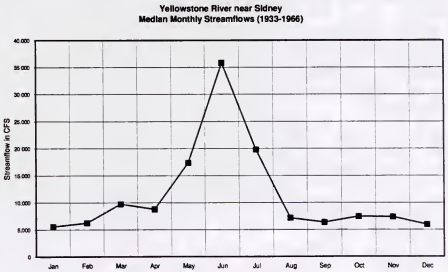



Figure 3.3-1. Yellowstone River Flow Hydrograph.

Other small prairie creeks, such as Crane Creek, Fox Creek and Sears Creek, and their tributaries, drain the area that would be irrigated by the WCSIP. Streamflow records are not available for these streams since they are not gaged, and carry relatively small amounts of water during much of the year. However, such streams can experience conditions ranging from no streamflow, to high flows which can occur during snow melt or following rain storms.

Table 3.3-1. Monthly Average and Percentile Streamflows in Cubic Feet per Second (cfs) for Yellowstone River at Sidney. (Based on 1933-1996 U.S. Geological Survey Streamflow Records)

| Percentile | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average | 5,636 | 6,864 | 10,852 | 9,702 | 17,331 | 36,346 | 21,595 | 7,688 | 6,889 | 8,089 | 7,451 | 5,939 |
| Q10 | 8,419 | 10,776 | 18,773 | 14,873 | 23,671 | 54,357 | 36,532 | 13,471 | 11,008 | 11,171 | 10,216 | 8,077 |
| Q20 | 7,016 | 8,435 | 13,716 | 12,510 | 20,641 | 49,243 | 31,316 | 10,583 | 8,753 | 10,111 | 9,059 | 7,497 |
| Q50 | 5,590 | 6,271 | 9,765 | 8,806 | 17,374 | 35,847 | 19,808 | 7,198 | 6,390 | 7,468 | 7,380 | 5,974 |
| Q80 | 4,297 | 4,618 | 6,625 | 6,914 | 12,718 | 24,100 | 11,427 | 4,730 | 4,061 | 5,957 | 5,800 | 4,236 |
| Q90 | 3,249 | 4,171 | 5,663 | 5,987 | 10,406 | 17,567 | 5,727 | 3,440 | 3,314 | 5,224 | 4,748 | 3,476 |
| Highest | 9,674 | 17,750 | 25,981 | 23,530 | 34,600 | 67,690 | 49,710 | 16,245 | 16,000 | 15,407 | 11,441 | 9,594 |
| Lowest | 2,087 | 2,702 | 5,191 | 2,821 | 5,409 | 12,232 | 3,683 | 1,602 | 2,389 | 4,210 | 3,974 | 3,019 |

## Water Quality

Water Quality in the lower Yellowstone River varies annually and with the seasons, but generally ranges from fair to good. The Yellowstone River near Sidney is classified by DEQ as B-3, meaning its waters are considered suitable for agricultural and industrial use, will support warm-water aquatic life, and are suitable for drinking after conventional treatment. Water quality is poorer in most of the smaller tributary streams in the project area, which are generally classified as C-3, considered suitable to support some aquatic life, but marginal for agricultural and industrial uses. An exception is Fox Creek and its tributaries, which are classified as B-2. Fox Creek generally has good water quality and is largely a perennial stream. It has moderate dissolved solids and suspended sediment concentrations, and cooler water temperatures. Surveys of Fox Creek and the North Fork of Fox Creek during the late 1970s and early 1980s revealed that the drainage contained a small, self-sustaining brook trout population (DNRC 1977, DFWP 1981). The Yellowstone River, Fox Creek, Crane Creek, and Sears Creek are listed by DEQ as water bodies that are in need of total maximum daily load (TMDL) development because they only partially support designated beneficial uses.

The discussion that follows further describes the water quality in the study area with emphasis on those water quality parameters that are of concern. A general summary of relevant water quality data for the Yellowstone River near Sidney is contained in Table 3.3-2. There is little or no water quality data for the smaller tributary streams in the project area.

Table 3.3-2. Summary Water Quality Observations for Yellowstone River Near Sidney.

| PARAMETER | Median | Min | Max |
|---|---|---|---|
| Total Dissolved Solids (TDS) | 505 mg/l | 158 mg/l | 874 mg/l |
| Electrical Conductivity (ECw) | .76 dS/m | .25 dS/m | 1.24 dS/m |
| Sodium Absorption Ration (SAR) | 1.9 | .9 | 2.8 |
| Sodium (Na) | 3 me/l (70 mg/l) | .9 me/l (21mg/l) | 6.1 me/l(140mg/l) |
| Chloride (Cl) | .3 me/l (12mg/l) | .1 me/l (3 mg/l) | .8 me/l (28 mg/l) |
| Boron (B) | .15 mg/l | .04 mg/l | .34 mg/l |
| Total Recoverable Arsenic (As) | 6 g/l | 4 g/l | 34 g/l |
| Total Suspended Sediment (TSS) | 366 mg/l | 18 mg/l | 9,080 mg/l |
| Water Temperature | 82 F | 61 F | 72 F |
| Dissolved Oxygen (DO)[1] | 8 mg/l | 6 mg/l | 9 mg/l |

mg/l = milligrams per liter
dS/m = deciSiemens per metre
me/l = milli-equivalents per liter
g/l = micrograms per liter
[1]July and August DO data

Source: USGS undated

### *Total Dissolved Solids (TDS)*

Total dissolved solids (TDS) is the sum of all dissolved solids in the water and can be used as a general measure of water salinity. Irrigation with water that has high TDS concentrations can decrease the productivity of soil due to problems associated with salt loading and soil permeability. High TDS concentration can also adversely affect the aquatic life in a stream.

TDS concentrations in the Yellowstone River near Sidney are moderate, and generally highest, when flows are lowest and salts become more concentrated, during such times as fall and winter. Figure 3.3-2 presents seasonal TDS concentrations for the Yellowstone River near Sidney. The electrical conductivity of water (ECw) is an indicator of TDS and is often used as a measure to analyze the suitability of water for irrigation.

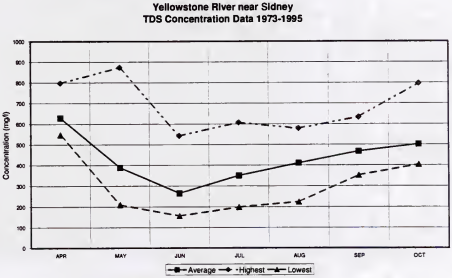



Figure 3.3-2. Yellowstone River TDS Concentrations.

## Sodium Adsorption Ration (SAR)

Irrigating with water having excessive sodium can destroy soil structure, reducing soil permeability. The SAR compares the availability of sodium relative to calcium and magnesium, and is a relative measure of the sodium hazard of irrigation water. Some soils are more at risk to sodium problems than others. For example, fine-textured clayey soils are at greatest risk to permeability problems, when irrigated with high sodium water. The SAR of water in the Yellowstone River water is generally low.

### *Sodium, Chloride, and Boron*

In high concentrations, these elements can be toxic to plants. Concentrations of Chloride (Cl) and Boron (B) are generally low for the Yellowstone River, and moderate for concentrations of Sodium (Na).

### *Arsenic*

Arsenic is a toxic element which can cause cancer. Arsenic occurs naturally, in moderate concentrations, in the Yellowstone River.

### *Total Suspended Sediment (TSS)*

TSS is a measure of all organic and inorganic solids suspended in water. High levels of TSS, especially in the form of sand, can cause excessive wear to irrigation pumps. Sediment in irrigation water can also clog soil pores and thereby reduce rates of water infiltration. Turbidity is often used as a measure of TSS.

In the Yellowstone River near Sidney, TSS concentrations are quite variable, but generally increase with increasing flows. This tendency is demonstrated in Figure 3.3-3, where TSS data for the Yellowstone River near Sidney site have been plotted with increasing discharge calibrated on the horizontal axis.

**Yellowstone River near Sidney**
**TSS/Discharge Data**

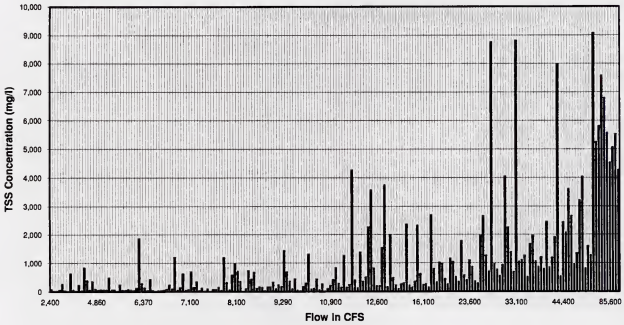



Figure 3.3-3. Yellowstone River TSS Data.

### *Temperature*

Excessive water temperatures can be harmful to aquatic life. The temperature of the Yellowstone River is generally highest during July and August. Recorded July temperatures in the Yellowstone River near Sidney have ranged from 61° to 79° F, with the average being about 72° F. Water temperatures recorded in August range from 63° F to 82° F, with the average being about 70° F.

### *Dissolved Oxygen*

Stream water naturally contains dissolved oxygen (DO), which is necessary for higher forms of aquatic life to survive. The amount of dissolved oxygen water can hold is strongly influenced by temperature: the capacity of water to hold DO decreases as water temperature increases. As streamflow decreases during the summer, water temperature generally increases, thereby reducing concentrations of DO. Late summer is a critical time for DO, when streamflows are typically lowest and water temperatures highest. Yellowstone River water generally contains DO at the moderate levels necessary to sustain warm-water aquatic life.

### *Suitability of Water for Irrigation*

Table 3.3-3 contains guidelines for determining the suitability of water for irrigation. Based on these guidelines and the water quality data summary in Table 3.3-2, Yellowstone River water is suitable for irrigation, with some minor restrictions. For instance, because TDS and ECw values are usually in the moderate range, the ability of the crop to use the water may be slightly restricted. Examining the SAR in conjunction with the ECw reveals that using the water for irrigation could cause slight to moderate decreases on soil infiltration. Chloride levels in the river water can be high enough to have slight to moderate effects on sensitive crops.

## Stream Channel Form

The Yellowstone River, in the vicinity of the WCSIP, flows through an alluvial valley that is approximately three to four miles wide. There are active river meanders, and numerous islands and side channels near the proposed diversion site. The riverbed and banks consist primarily of sand and silt, and the stream carries a moderate-to-high sediment load (see Table 3.3-2, and TSS discussion under water quality).

The proposed diversion site is located on the outside of a stream meander bend. This bend has been actively eroding and migrating toward the west. Figure 3.3-4 shows how the position of the riverbank at the proposed diversion site has changed over the last 40 years.

Table 3.3-3. Guidelines for Interpretations of Water Quality for Irrigation.

| Potential Irrigation Problem | Units | Degree of Restriction on Use: None | Slight to Moderate | Severe |
|---|---|---|---|---|
| **Salinity (affects crop water availability)** | | | | |
| $EC_W$ | dS/m | <0.7 | 0.7 – 3.0 | >3.0 |
| (or) | | | | |
| TDS | mg/1 | <450 | 450 – 2000 | >2000 |
| **Infiltration (affects infiltration rate of water into the soil. Evaluate using $EC_W$ and SAR together)** | | | | |
| SAR = 0 – 3 and $EC_W$ = | | >0.7 | 0.7 – 0.2 | <0.2 |
| 3 – 6 = | | >1.2 | 1.2 – 0.3 | <0.3 |
| 6 – 12 = | | >1.9 | 1.9 – 0.5 | <0.5 |
| 12 – 20 = | | >2.9 | 2.9 – 1.3 | <1.3 |
| 20 – 40 = | | >5.0 | 5.0 – 2.9 | <2.9 |
| **Specific Ion Toxicity (affects sensitive crops)** | | | | |
| Sodium (Na) | | | | |
| Surface irrigation | SAR | <3 | 3 – 9 | >9 |
| Sprinkler irrigation | me/1 | <3 | >3 | |
| Chloride (Cl) | | | | |
| Surface irrigation | me/1 | <4 | 4 – 10 | >10 |
| Sprinkler irrigation | me/1 | <3 | >3 | |
| Boron (B) mg/1 | | <0.7 | 0.7 – 3.0 | >3 |
| **Miscellaneous Effects (affects susceptible crops)** | | | | |
| Nitrogen (NO3 – N) | mg/1 | <5 | 5 – 10 | >30 |
| Bicarbonate (HCO3) (overhead sprinkling only) | me/1 | <1.5 | 1.5 – 8.5 | >8.5 |
| pH | | | Normal Range 6.5 – 8.4 | |

1. ECW means electrical conductivity, a measure of the water salinity, reported in deciSiemens per metre at 25oC (dS/m) or in units millimhos per centimetre (mmho/cm). Both are equivalent.
2. TDS means total dissolved solids, reported in milligrams per litre (mg/1).
3. SAR means sodium absorption ratio. At a given SAR, infiltration rate increases as water salinity increases.

Source: FAO 1985

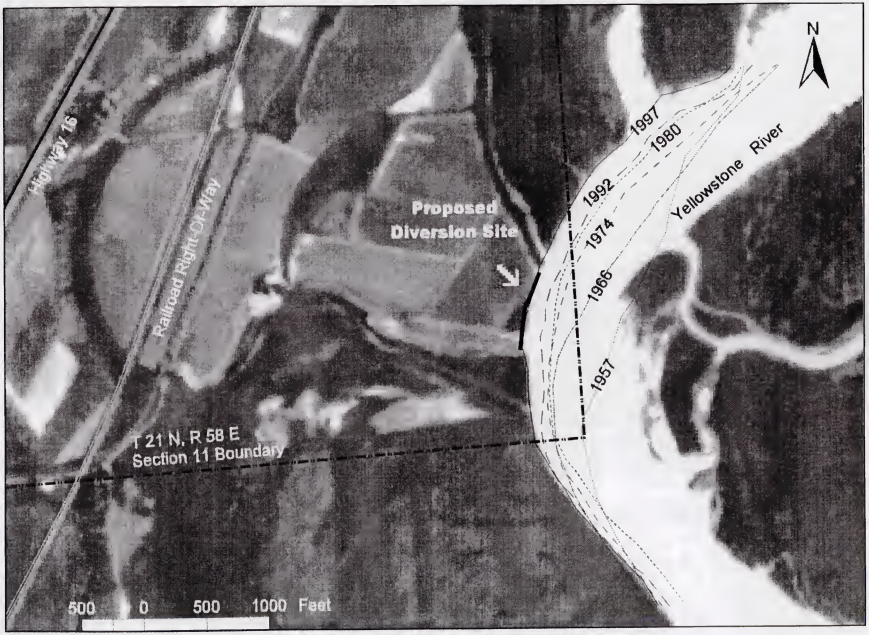



Figure 3.3-4. Changes in Location of Yellowstone River Bank Near the Proposed Diversion Site for the WCSIP.

## 3.4 Ground Water

The information presented in this section draws heavily on preliminary results from the ground water characterization study recently completed by the Montana Bureau of Mines and Geology for the lower Yellowstone River area. Although other reports were consulted (MWRS 1971, Slagle 1981, Slagle and others 1984, McKenna et. al. 1994), the Montana Bureau of Mines and Geology report provides the most current information.

The distribution and physical properties of the geologic units of eastern Montana affect the availability, movement and quality of groundwater in Richland County. Geologic units in eastern Montana are predominantly sandstone, siltstone, and shale, locally overlain by unconsolidated silt, sand, and gravel deposits. The geologic units are described in Table 3.4-1. The Fort Union Formation is exposed at the surface over approximately 50 percent of the project site. In the remainder of the project area, the Fort Union Formation is mantled by Quaternary and Quaternary-Tertiary sand and gravel deposits ranging from a thin veneer to 50 feet in thickness (Smith, 1998a).

Table 3.4-1. Description of Geologic Units Underlying WCSIP

| Unit | Age | Thickness (ft) | Description |
|---|---|---|---|
| **Unconsolidated Alluvium** | Quaternary | 0 to 100 | Sand, gravel, and minor silt and clay deposited along major stream valleys |
| **Unconsolidated Terrace Deposits** | Quaternary Tertiary | 0 to 120+ | Sand, gravel, silt and clay deposited on and below upland benches (stream terraces); includes glacial till deposits |
| **Fort Union Formation** | Tertiary | 0 to 1,200+ | Interbedded fine to medium-grained sandstone, siltstone, and mudstone; coal, coaly, shale, and clinker beds. Sandstone and mudstone beds maybe up to 100 ft thick. |
| **Hell Creek Formation** | Cretaceous | 0 to 150 | Silty shale, mudstone, bentonitic shale, fine to medium sandstone, and a few thin coal or clinker beds. |
| **Fox Hills Formation** | Cretaceous | 70 to 350 | Interbedded fine to medium-grained sandstone, sandy shale, siltstone, and minor carbonaceous shale. |
| **Pierre Shale** | Cretaceous | 1,300 to 2,600 | Shale and bentonitic shale with few thin sandstone and siltstone beds, |

Source: USGS, 1984 and MBMG, 1998.

### Hydrogeologic Units

Aquifers are rocks or unconsolidated deposits that contain sufficient saturated permeable material to yield usable quantities of water to wells and springs. Aquifer materials common in eastern Montana are sandstone, coal beds and unconsolidated sand and gravel. Confining units (nonaquifers) are materials that are relatively impermeable, restrict the vertical movement of water between aquifers, and yield little or no water to wells or springs. Confining units include mudstone, shale, silty and clayey sandstone, unconsolidated silt and clay beds, and glacial till.

Aquifers in Richland County have been identified and described by several authors based on various lithologic and water-transmitting characteristics (MWRS, 1971, Slagle and others). As part of the Montana

Bureau of Mines and Geology ground water characterization report, Smith (1998), identified three hydrologic units beneath Richland County. These hydrologic units are described below.

1 The Shallow Hydrologic Unit (SHU) consists of all aquifers and confining units within approximately 200 feet of the land surface, exclusive of the Fox Hills–lower Hell Creek aquifer. Geologic units include unconsolidated Quaternary alluvial deposits and Quaternary/Tertiary terrace deposits, the Fort Union Formation, and in places, the upper part of the Hell Creek Formation (Figure 3.4-1).

2 The Deep Hydrologic Unit (DHU) consists of all aquifer and nonaquifer materials that occur at depths equal to or greater than approximately 200 feet below the land surface, and that lie stratigraphically above the Fox Hills-lower Hell Creek aquifer. Geologic units include the Fort Union Formation and the upper part of the Hell Creek Formation.

3 The Fox Hill-lower Hell Creek aquifer consists of nearly continuous sandstone beds in the lower part of the Hell Creek Formation, and most of the Fox Hills Formation.

Although all three aquifer units yield water to wells in Richland County, only the SHU has reasonable potential to be impacted by the WCSIP. Therefore, the remainder of this section will focus on the SHU. The bottom of the SHU is not defined by a continuous geologic or hydrologic marker, but instead is transitional with the underlying DHU. Differences in water quality and ground water flow are sufficient to justify separating the units at about 200 feet below the land surface (Patton, et al., 1998). Although the SHU consists of a variable sequence of aquifers and confining units, there is sufficient hydraulic continuity to consider it a single entity in terms of ground water flow (Patton, et al, 1998).

Figure 3.4-1. Relationship Between Geologic and Hydrologic Units in Richland County

| Geologic Unit | Hydrologic Unit | Depth to Top (ft) |
|---|---|---|
| Quaternary Deposits | Shallow Hydrologic Unit | 0 to < 200 |
| Quaternary & Tertiary Deposits | | |
| Fort Union Formation | Deep Hydrologic Unit | 200 |
| Hell Creek Formation | Confining Unit | ~100 to 1,400 |
| Fox Hill Formation | Fox Hills-lower Hell Creek Aquifer | ~200 to 1,600 |
| Pierre Shale | Confining Unit | ~300 to 2,000 |

Adapted from Smith, 1998

## Ground Water Flow and Ground Water Quality

The Montana Bureau of Mines and Geology Ground Water Information Center (GWIC) database indicates there are 54 wells within the project area (Table 3.4-2). The majority of the wells are used for either stockwater (27 wells) or domestic (15 wells) purposes. The available information indicates the wells range in depth from 13 feet to 214 feet below ground surface, with an average depth of 61 feet. All but seven wells are completed in either alluvium, gravel or terrace deposits. The depth to ground water ranges from 13 feet to 175 feet below the ground surface. The average depth to ground water is approximately 92 feet below the ground surface.

In general the potentiometric surface of the SHU is a subdued representation of the land-surface topography; the highest ground water elevations occur beneath topographic highs and the lowest occur beneath topographic lows. The ground water flow pattern is characterized by numerous local flow systems where ground water moves from local drainage divides (topographic highs) toward nearby valley bottoms. In the valley bottoms, flow is down-valley and toward the Yellowstone River.

Water recharges the shallow ground water system from infiltration of precipitation, and losses from streams. In currently irrigated areas, deep percolation of irrigation water and leakage from ditches also contributes to shallow ground recharge.

Ground water in the SHU beneath the project site is generally of good quality. The ground water has been classified as a calcium-magnesium-bicarbonate type with low concentrations of dissolved constituent (<2,000 mg/L) (LaFave and Patton, 1998). This chemical signature is indicative of ground water in recharge areas (LaFave & Patton, 1998).

Table 3.4-2. Ground Water Wells Completed in the Shallow Hydrologic Unit

| Well No. | Location | Depth to Ground Water (ft) | Well Depth (ft) | Yield (gpm) | Lithology | Use |
|---|---|---|---|---|---|---|
| M:35125 | 21N 56E 12 C 01 | 22 | 47 | --- | Alluvium | Monitoring |
| M:35126 | 21N 56E 12 C 01 | 22 | 47 | --- | Alluvium | Monitoring |
| M:35127 | 21N 56E 12 C 02 | 22 | 57 | --- | Alluvium | Monitoring |
| M:35128 | 21N 56E 12 C 03 | 22 | 42 | --- | Alluvium | Monitoring |
| M:35129 | 21N 56E 12 CC 01 | --- | 30 | --- | Alluvium | Stockwater |
| M:35130 | 21N 56E 12 CC 02 | --- | 30 | --- | Alluvium | Stockwater |
| M:35131 | 21N 56E 12 CC 03 | --- | 60 | --- | Terrace Gravel | Stockwater |
| M:142075 | 21N 56E 12 CCBD 01 | 42 | 95 | 18 | Terrace Gravel | Domestic |
| M:126755 | 21N 56E 12 CDCB 01 | 26 | 75 | 14.5 | Terrace Gravel | Stockwater |
| M:35137 | 21N 56E 24 BBC 01 | 51 | 100 | 8 | Terrace Gravel | Stockwater |
| M:35149 | 21N 57E 08 DBB 01 | 20 | 80 | 9 | Terrace Gravel | Stockwater |
| M:35150 | 21N 57E 09 CDC 01 | 20 | 40 | 9 | Terrace Deposits | Stockwater |
| M:35152 | 21N 57E 10 C 01 | 65 | 85 | 7 | Terrace Gravel | Stockwater |
| M:2636 | 21N 57E 10 CDDD 01 | 117 | 214 | 11 | Terrace Gravel | Domestic |
| M:35153 | 21N 57E 13 ACDC 01 | --- | 60 | --- | Terrace Gravel | Stockwater |
| M:700494 | 21N 57E 14 CDCC 01 | --- | 85 | 9 | Ft. Union Fm. | Domestic |
| M:142678 | 21N 57E 15 BAAB 01 | --- | 210 | 11 | Ft. Union Fm. | Domestic |
| M:35154 | 21N 57E 16 DCB 01 | 90 | 132 | 8 | Terrace Gravel | Stockwater |
| M:700495 | 21N 57E 16 DCCB 01 | --- | 133 | --- | --- | Unused |
| M:35155 | 21N 57E 19 AAAA 01 | 130 | 163 | 18 | Terrace Gravel | Stockwater |
| M:35157 | 21N 57E 22 CDA 01 | 30 | 50 | 7 | Terrace Gravel | Stockwater |
| M:700496 | 21N 57E 23 AA 01 | --- | 150 | --- | --- | Unused |
| M:35158 | 21N 57E 23 BA 01 | 50 | 80 | 7 | Terrace Gravel | Stockwater |
| M:35159 | 21N 57E 24 AAA 01 | 110 | 150 | --- | Terrace Gravel | Stockwater |
| M:35161 | 21N 57E 27 BDD 01 | 95 | 120 | 5 | Terrace Gravel | Stockwater |
| M:35162 | 21N 57E 29 DDDB 01 | 48 | 60 | 30 | Terrace Deposits | Stockwater |
| M:35166 | 21N 57E 33 A 01 | 55 | 65 | 7 | Terrace Gravel | Stockwater |
| M:35167 | 21N 57E 33 AADD 01 | 65 | 125 | 8 | Terrace Gravel | Stockwater |

| Well No. | Location | Depth to Ground Water (ft) | Well Depth (ft) | Yield (gpm) | Lithology | Use |
|---|---|---|---|---|---|---|
| M:35179 | 21N 58E 04 AAA 01 | 108 | 158 | 24 | Terrace Gravel | Stockwater |
| M:700502 | 21N 58E 05 BA 01 | --- | 38 | --- | --- | Stockwater |
| M:35180 | 21N 58E 05 DCA 01 | 50 | 80 | 280 | Terrace Gravel | Stockwater |
| M:139762 | 21N 58E 08 01 | 20 | 37 | 20 | --- | Stockwater |
| M:700504 | 21N 58E 08 DD 01 | --- | 15 | --- | --- | Irrigation |
| M:700505 | 21N 58E 08 DDAD 01 | --- | 40 | 6 | Ft. Union Fm. | Domestic |
| M:35181 | 21N 58E 09 AAD 01 | 55 | 113 | 50 | Terrace Gravel | Industrial |
| M:35182 | 21N 58E 09 AD 01 | 80 | 150 | 20 | Terrace Gravel | Unknown |
| M:35183 | 21N 58E 10 AABB 01 | 13 | 51 | 10 | Terrace Deposits | Domestic |
| M:700506 | 21N 58E 10 DC 01 | --- | 42 | --- | --- | Stockwater |
| M:35184 | 21N 58E 10 DCC 01 | 21 | 24 | 3 | Terrace Deposits | Domestic |
| M:35185 | 21N 58E 10 DCC 02 | 21 | 48 | 5 | Terrace Deposits | Stockwater |
| M:35186 | 21N 58E 10 DCCC 01 | 21 | 24 | 3 | Terrace Deposits | Domestic |
| M:700519 | 21N 58E 18 DC 01 | --- | 160 | --- | --- | Domestic |
| M:700520 | 21N 58E 20 AA 01 | --- | 72 | --- | --- | Stockwater |
| M:35689 | 22N 57E 14 DBCB 01 | --- | 41 | 8 | Terrace Gravel | Domestic |
| M:152195 | 22N 57E 14 DBCB 02 | --- | 75 | --- | Terrace Gravel | Domestic |
| M:35694 | 22N 57E 26 D 01 | 55 | 75 | 10 | Terrace Gravel | Domestic |
| M:700574 | 22N 58E 06 BABD 01 | --- | 90 | 10 | Ft. Union Fm. | Domestic |
| M:700575 | 22N 58E 07 DCCD 01 | --- | 140 | --- | Ft. Union Fm. | Domestic |
| M:35704 | 22N 58E 08 AB 01 | 135 | 177 | 5 | Terrace Gravel | Domestic |
| M:35705 | 22N 58E 08 ABB 01 | --- | 140 | 5 | Terrace Gravel | Stockwater |
| M:35741 | 22N 58E 17 AAC 01 | --- | 160 | 5 | Terrace Gravel | Stockwater |
| M:700576 | 22N 58E 17 BBBB 01 | --- | 29 | --- | --- | Commercial |
| M:35765 | 22N 58E 32 D 01 | 175 | 190 | 6 | Ft. Union Fm. | Stockwater |
| M:35767 | 22N 58E 33 A 01 | 165 | 200 | 6 | Ft. Union Fm. | Stockwater |

Source:Information compiled from the Montana Bureau of Mines and Geology Ground Water Information Center

Notes:--- = No data available

## 3.5 Soils

Based on the Soil Conservation Service published soil survey of Richland County (SCS, 1980), approximately 20 different soil mapping units will be directly affected by the WCSIP. The affected soil mapping units are shown in Table 3.5-1. Seven primary soil types account for approximately 95 percent of the project soils. Three of these soils account for 83 percent of the proposed soils. The seven primary soil mapping units are: the Turner-Beaverton complex, 0 to 4 percent slopes; the Vida-Zahill complex, 4 to 8 percent and 8 to 15 percent slopes; the Zahill loam, 15 to 65 percent slopes; the Vida clay loam, 1 to 4 percent and 4 to 8 percent slopes; and the Williams loam, 0 to 4 percent slopes.

Soils within the project area are generally deep, well drained, and have a high water holding capacity. Approximately 95 percent of the soils were formed from calcareous clay loam glacial till. The remainder of the soils were formed from alluvium or sediments of the Fort Union formation. Some of the soils contain high amounts of calcium carbonate. Because many of the soils are of glacial origin, they can be very stony. Approximately 1,660 acres (13.9 percent) of the 11,965 acres proposed for irrigation are classified as Highly Erodable Lands by the NRCS. These soils are shown in Table 3.5-1. In general, the seven primary soil types have moderately slow permeabilities (0.2 - 0.6 in/hr), initial cylinder intake rates of 0.5 - 1.0 in/hr and present moderate to slight erosion hazards.

Table 3.5-1. WCSIP Soils Information

| Soils Series Name | Soil Series Symbol | Total Acreage[1] | Percent Total Acreage | Highly Erodable Soils[2] (Y/N) | Permeability (in/hr)[3] | Available Water Capacity[3] (in/in soil) | Runoff[3] | Current Use and Comments |
|---|---|---|---|---|---|---|---|---|
| Lambert & Blanchard Complex; 8 to 25% slopes. | LeD | 0.4 | 0.00 | Yes | 0.2 - 20 | 0.1 - 0.2 | Slow to very rapid | Rangeland. |
| Shambo loam; 0 to 2 % slopes. | ShA | 5.2 | 0.04 | No | 0.6 - 2.0 | 0.16 - 0.20 | Slow | Dryfarmed, irrigated, & rangeland. |
| Cherry, Havreson, & Trembles soils. | Ch | 7.5 | 0.06 | Yes | 0.2 - 6.0 | 0.14 - 0.20 | Slow | Rangeland. |
| Typic Haplequents | Tw | 8.1 | 0.07 | No | N/A | N/A | Ponded to slow | Saline Lowland range site. |
| Lihen loamy fine sand; 4 to 15% slopes. | LmD | 14.4 | 0.12 | Yes | 6.0 - 20 | 0.08 - 0.12 | Slow to moderate | Rangeland. High hazard of soil blowing. |
| Havreson silt loam; 0 to 1% slopes. | HaA | 15.1 | 0.13 | No | 0.6 - 2.0 | 0.16 - 0.20 | Very slow to slow | Rangeland and irrigated crops. |
| Shambo-Lambert complex; 4 to 8% slopes. | SmC | 21.5 | 0.18 | Yes | 0.2 - 2.0 | 0.16 - 0.20 | Medium | Dryfarmed and range |
| Banks loamy fine sand; 0 to 4% slopes. | BkB | 29.3 | 0.25 | Yes | 6.0 - 20.0 | 0.10 - 0.14 | Very slow | Range and irrigated crops. High hazard of soil blowing. |
| Lambert silt loam; 2 to 8% slopes. | LbC | 47.2 | 0.39 | Yes | 0.2 - 0.6 | 0.16 - 0.20 | Medium | Dryfarmed and range. |
| Farnuf loam; 0 to 2% slopes. | FaA | 84.4 | 0.71 | No | 0.6 -2.0 | 0.16 - 0.20 | Slow | Dryfarmed and irrigated crops. |
| Shambo loam; 2 to 4% slopes. | ShB | 94.1 | 0.79 | No | 0.6 - 2.0 | 0.16- -0.20 | Slow to medium | Dryfarmed, irrigated crops, & rangeland. |
| Tinsley soils; 15 - 65% slopes. | TeF | 111.4 | 0.93 | Yes | 6.0 - 20.0 | <0.03 | Very slow to slow | Rangeland. High hazard of soil blowing. |
| Boxbelis silt loam; 0 to 4% slopes. | BoB | 156.2 | 1.3 | No | 0.20 - 0.60 | 0.16 - 0.20 | Very slow to slow | Dryfarmed and rangeland. |
| Turner-Beaverton complex; 0 to 4% slopes. * | ToB | 216.3 | 1.8 | Yes | 0.60 - 2.0 | 0.12 - 0.15 | Slow | Dryfarmed, irrigated crops, & rangeland. |
| Vida-Zahill complex; 8 - 15% slopes. * | VhD | 292.1 | 2.4 | Yes | 0.20 - 0.60 | 0.16 - 0.20 | Rapid | Rangeland. |
| Zahill loam; 15 to 65% slopes. * | ZaF | 456.2 | 3.8 | Yes | 0.20 - 0.60 | 0.16 - 0.20 | Rapid | Rangeland. |
| Vida-Zahill Complex; 4 to 8% slopes. * | Vhc | 463.9 | 3.9 | Yes | 0.20 - 0.60 | 0.16 - 0.20 | Medium to rapid | Dryfarmed and rangeland |
| Vida clay loam; 4 to 8% slopes. * | VdC | 3,043.8 | 25.5 | No | 0.2 - 0.6 | 0.16 - 0.20 | Medium to rapid | Dryfarmed and rangeland |
| Vida clay loam; 1 to 4% slopes. * | VdB | 3,260 | 27.3 | No | 0.2 - 0.6 | 0.16 - 0.20 | Slow to medium | Dryfarmed and rangeland. |
| Williams loam; 0 to 4% slopes. * | WmB | 3,624.9 | 30.3 | No | 0.2 - 0.6 | 0.16 - 0.20 | Very slow to medium | Dryfarmed and rangeland. |

NOTES:

1. MT Dept of Natural Resources and Conservation estimate.
2. NRCS, Sidney, MT.
3. Soil Survey of Richland County, MT 1980.

* Indicates one of seven primary soil types found in subject area.

## 3.6 Economic and Social Factors

Richland County exhibits many of the traits common to rural counties in eastern Montana and western North Dakota, including a sparse population, distance from a metropolitan area, and an economy based on agriculture. The largest town in the county, Sidney, has been described as one of Montana's *"third-tier"* communities, providing limited commercial and health services to local residents and businesses (Nicholson and Nesari, 1994). A broader range of services is available in Williston, North Dakota, approximately 60 miles to the northeast, or Billings, Montana, approximately 275 miles to the southwest.

### Population

The county's declining population over the last two decades can largely be explained by the passing of the oil boom of the late 1970s. The censuses of 1980 and 1990 report Richland County's population as 12,243 and 10,716, respectively--a decrease of 12.5 percent. By comparison, the population of the state grew by 1.5 percent during the same period, from 786,690 to 799,065. As of July 1, 1997, Richland County's population was estimated at 10,191—to the twentieth (of 56) most populous county in the state. This change in population reflects a decrease of 4.9 percent since 1990. During this period, the state's population increased by 10 percent to 878,810 (Montana Department of Commerce, undated).

### Employment

Total full-time and part-time employment for 1996 was estimated at 5,950, a 9 percent increase since 1991. Total employment included 642 employed on farms, 723 employed by government and government enterprises (607 of which are at the state and local level), and 4,585 employed in private enterprises. Private sector employment included: agricultural services, forestry, and fisheries (141); mining (327); construction (342); manufacturing (380); transportation and public utilities (296); wholesale trade (209); retail trade (1,177); finance, insurance, and real estate (267); and services (1,446--over half of which are in health care). Since 1991, farm employment has decreased by 9.6 percent, employment in the private sector has increased by 15 percent, and government employment has decreased by 1 percent. Within the private sector, the greatest changes have occurred in agricultural services (+41 percent), construction (+37 percent), retail trade (+27 percent), and services (+21 percent). Declines have occurred in mining (-14 percent) and transportation and public utilities (-4.5 percent) (U.S. Bureau of Economic Analysis, undated).

### Income

Earnings of persons employed in Richland County increased from $92.97 million in 1986 to $111.62 million in 1996, an average annual growth rate of 1.8 percent. The largest industries in 1996 were services (20.7 percent of earnings), state and local government (12.2 percent), and mining (11.6 percent). In 1986, the largest industries were mining (17.6 percent), services (16.1 percent), and state and local government (12 percent). Of the industries that accounted for at least 5 percent of earnings in 1996, the slowest growing from 1986 to 1996 was mining, which decreased at an average annual rate of 2.4 percent; the fastest was services which increased at an annual rate of 4.5 percent.

Total personal income (TPI) includes the earnings (wages and salaries, other labor income, and proprietors' income); dividends, interest, and rent; and transfer payments received by the residents of Richland County. In 1996, earnings were 56 percent of TPI; dividends, interest, and rent were 22.1 percent; and transfer payments were 21.9 percent. From 1986 to 1996, earnings increased on average 1.8 percent each year, dividends, interest, and rent increased on average 1.0 percent, and transfer payments increased on average 6.0 percent. In 1996, Richland County's TPI was $182 million. This TPI ranked 16th in the state and accounted for 1.1 percent of the state total. In 1986, Richland County's TPI was $143 million and ranked 15th in the state. The average annual growth rate of TPI over the last ten years was 2.4 percent. The average annual growth rate for the state was 5.5 percent and for the nation was 5.9 percent.

In 1996, Richland County had a per capita personal income (PCPI) of $17,810. This PCPI ranked 20th in the state, was 92 percent of the state average, $19,278, and 73 percent of the national average, $24,436.

In 1986, the PCPI of Richland County was $11,357 and ranked 29th in the state. The average annual growth rate of PCPI over the last ten years was 4.6 percent. The average annual growth rate for the state was 4.7 percent and for the nation was 4.9 percent (U.S. Bureau of Economic Analysis, undated).

### Taxation

The total taxable value of property in Richland County for the 1998 tax year was $21.05 million (1.1 percent of the state total). The taxable value of Class 3 agricultural land in the county was $3.78 million (2.6 percent of the state total). For tax purposes, agricultural land is evaluated based on various factors such as crop and length of growing season. In 1998, the tax rate for each category of land was 3.816 percent. The average mill levy for Richland County in 1998 was 392.599. The property tax per acre on irrigated acres in Richland County is between $7 and $9, around $2 for dry land acreage, and between $.50 and $2 on grazing land (Montana Department of Revenue, 1998).

### Agricultural Sales

Cash receipts from agricultural marketing in Richland County in 1996 totaled $59.88 million--ranked 12$^{th}$ among Montana's 56 counties. Total cash receipts for the state were $2,118 million. Of this total, $18.85 million was generated by livestock sales, and $41.03 million by crop sales. In addition, government payments of $6.12 million were received in the county. Production expenses were estimated to be $61.79 million for 1996. Total farm labor and proprietors' income was estimated to be $7.93 million. Spring wheat, sugar beets, hay, barley, and winter wheat contributed the major portion of cash receipts from agricultural marketing for Richland County in 1996 (Montana Agricultural Statistics Service, 1998).

## 3.7 Wildlife

Common birds and mammals found or that may occur in Richland County in the vicinity of the WCSIP are listed in Table 3.7-1. The bald eagle, a threatened species, is known to occur in the project area. The interior least tern, an endangered species, nests on gravel bars in the lower Yellowstone River, but generally upstream of the proposed diversion site--the nearest tern nesting site observed during a comprehensive least tern nesting ecology study was about 15 miles upstream (Bacon 1996). The piping plover, a threatened species, may migrate through the Yellowstone River corridor in the project area. No prairie dogs were observed in the project area during a reconnaissance survey by the wildlife biologist.

Table 3.7-1. Birds and Mammals that May Occur in the Vicinity of the West Crane Sprinkler Irrigation Project.

| | | |
|---|---|---|
| **i) Arboreal Nesting Birds** | | |
| Eastern Kingbird | Western Kingbird | Says Phoebe |
| Dusky Flycatcher | Least Flycatcher | Western Wood Peewee |
| Tree Swallow | Violet Green Swallow | Black Billed Magpie |
| Black Capped Chickadee | American Robin | Loggerhead Shrike |
| Grey Catbird | Brown Thrasher | Red Eyed Vireo |
| Warbling Vireo | Black & White Warbler | Yellow Rumped Warbler |
| Yellow Warbler | Common Yellowthroat | Yellow Breasted Chat |
| Ovenbird | American Redstart | Mourning Dove |
| Lazuli Bunting | Rufous Sided Towhee | Chipping Sparrow |
| Clay Colored Sparrow | Brewer's Blackbird | Brown Headed Cowbird |
| Common Grackle | Northern Oriole | Orchard Oriole |
| American Goldfinch | House Wren | Song Sparrow |
| **ii) Ground Nesting Birds** | | |
| Sharptail Grouse | Ringnecked Pheasant | Hungarian Partridge |
| Merriams Turkey | Short Eared Owl | Mccowns Longspur |
| Spragues Pipit | Bairds Sparrow | Grasshopper Sparrow |
| Vesper Sparrow | Savannah Sparrow | Brewers Sparrow |
| Lark Sparrow | Field Sparrow | Chipping Sparrow |
| Western Meadowlark | Chestnut Collared Longspur | Bobolink |
| Lark Bunting | Mourning Dove | Dickcissel |
| Brewer's Blackbird | Marbled Godwit | Long Billed Curlew |
| Northern Harrier | Upland Sandpiper | Common Nighthawk |
| **iii) Raptorial Birds** | | |
| Bald Eagle | Golden Eagle | Swainsons Hawk |
| Ferruginous Hawk | Red Tailed Hawk | Rough Legged Hawk |
| Prairie Falcon | Kestrel | Merlin |
| Peregrine Falcon | Turkey Vulture | Cooper's Hawk |
| Sharp Shinned Hawk | Great Horned Owl | |
| **iv) Mammals** | | |
| Pocket Gopher | Western Harvest Mouse | Deer Mouse |
| Grasshopper Mouse | Meadow Vole | Prairie Vole |
| Desert Cottontail | Mule Deer | Whitetailed Deer |
| Antelope | Red Backed Vole | White Footed Mice |
| Eastern Cottontail | Coyote | Bobcat |
| Badger | Beaver | |

## 3.8 Fisheries

There are over 50 different fish species in the lower Yellowstone River of which one is listed as Endangered, four are listed as Species of Special Concern, and nine as gamefish species. The status, size, egg size, spawning season, and habitat types for these fish are shown in tables 3.8-1 through 3.8-4.

Table 3.8-1. Fish Species that Occur in the Yellowstone River in the Vicinity of the Proposed Project and their status.

| Common name | Scientific Name | Status |
|---|---|---|
| Pallid Sturgeon | Scaphirhynchus albus | Federally endangered |
| Shovelnose Sturgeon | Scaphirynchus platorynchus | game fish, common |
| Paddlefish | Polydon spathula | game fish, species of concern |
| Shortnose Gar | Lepisosteus platostomus | species of concern |
| Western silvery Minnow | Hybognathus argyritis | potential concern |
| Plains Minnow | Hybognathus placitus | potential concern |
| Sturgeon Chub | Macrhybopsis gelida | species of concern |
| Sicklefin Chub | Macrhybopsis meki | species of concern |
| Flathead Chub | Platygobio gracilis | potential concern, common |
| Blue Sucker | Cycleptus elongatus | species of concern |
| Channel Catfish | Ictalurus punctatus | game fish, common |
| Northern Pike | Esox lucius | game fish, common |
| Burbot | Lota lota | game fish, |
| Sauger | Stizostedion canadense | game fish, potential concern |
| Walleye | Stizostedion vitreum | game fish, common |

Table 3.8-2. Minimum and Maximum Size of Fish by Species Collected in the Area. "Egg", Indicates Probable Spawning in Area Due to Capture of Eggs or Young-of-year Fish in Area.

| Common name | Length range (mm) | Weight range (grams) |
|---|---|---|
| Pallid Sturgeon | 220-1430 | 300-18100 |
| Shovelnose Sturgeon | egg-823 | 0.1-2900 |
| Paddlefish | egg-1500 | 0.1-46250 |
| Shortnose Gar | rarely found | |
| Western Silvery Minnow | egg-95 | 0.1-9 |
| Plains Minnow | egg-95 | 0.1-9 |
| Sturgeon Chub | egg-90 | 0.1-9 |
| Sicklefin Chub | egg-110 | 0.1-9 |
| Flathead Chub | egg-260 | 0.1-136 |
| Blue Sucker | 370-770 | 340-3629 |
| Channel Catfish | egg-650 | 0.1-2700 |
| Northern Pike | egg-760 | 0.1-4800 |
| Burbot | egg-500 | 0.1-2000 |
| Sauger | egg-490 | 0.1-953 |
| Walleye | egg-560 | 0.1-4536 |

Note: Pallid sturgeon and blue sucker should be found as juveniles in this area, but sampling to date has not provided evidence of these species.

Table 3.8-3. Size of Each Species Egg, Information Derived From Literature Review (Scott and Crossman. 1979). Also Shown, is the Time When Various Species are Most Likely to Spawn.

| Common name | egg size | Spawning time period |
|---|---|---|
| Pallid Sturgeon | 2.6 mm | May thru July |
| Shovelnose Sturgeon | 2.4 mm | May thru July |
| Paddlefish | 3.5 mm | April thru June |
| Shortnose Gar | 2.6 mm | May thru July |
| Western Silvery Minnow | | ? Summer |
| Plains Minnow | | ? Summer |
| Sturgeon Chub | | ? Summer |
| Sicklefin Chub | | ? Summer |
| Flathead Chub | | ? Summer |
| Blue Sucker | 3.4 mm | April thru June |
| Channel Catfish | 3.7 mm | June thru August |
| Northern Pike | 2.8 mm | April thru May |
| Burbot | 1.3 mm | February thru March |
| Sauger | 1.3 mm | May thru June |
| Walleye | 1.7 mm | April thru May |

Note: The larval drift timing for each species is provided to identify Biological Sensitive Periods (BSP) for each species in regard to irrigation withdrawal.

Table 3.8-4 Habitat Use for Each Species.

| Common name | General Habitat |
|---|---|
| Pallid Sturgeon | over sand and gravel in moving water deep water |
| Shovelnose Sturgeon | over sand and gravel in moving water deep water |
| Paddlefish | slow quiet waters in large rivers and bays deep water |
| Shortnose Gar | backwaters shallow water |
| Western Silvery Minnow | slow water over sand and gravel shallow water |
| Plains Minnow | slow water over sand and gravel shallow water |
| Sturgeon Chub | moving water over sand and gravel deep to shallow water |
| Sicklefin Chub | fast water over sand and gravel deep water |
| Flathead Chub | moving water over silt to gravel deep to shallow water |
| Blue Sucker | swift currents over sand, gravel, and rocky bottoms |
| Channel Catfish | slow water over silt to gravel shallow to deep water |
| Northern Pike | slow water over silt and sand shallow to deep water |
| Burbot | moving water sand, gravel, and rock deep water |
| Sauger | moving water over sand and gravel shallow to deep water |
| Walleye | slow water over silt and sand deep water |

Note: Fish over moving water with sand to gravel preference and shallow to deep water have the most potential to be affected by irrigation withdrawals.

## 3.9 Cultural Resources

Although no paleontological sites have been identified in the proposed area of potential effect (APE), several cultural resource sites are documented in, or near, the APE. Cultural resource sites identified in the general project area include historic white settlement, irrigation systems, travel systems, and prehistoric campsites. Some of the cultural resource sites have been determined to be eligible for listing on the National Register of Historic Places (NRHP), some have been determined to be ineligible for listing on the NRHP, and others have not been evaluated to determine whether or not they are eligible for listing on the NRHP. Based on the presence of nearby existing sites, and the environmental and topographic qualities of the project area, there is a high likelihood that there are cultural resource sites within the project area.

## 3.10 Recreation

### Yellowstone River

In 1977, water-based recreation on the Yellowstone River was evaluated as part of the Yellowstone Impact Study (DNRC 1977) which used two techniques to evaluate recreational behavior: The measurement of demographic, social, and other individual and group characteristics; and an examination of the resource itself to determine recreational opportunities. Study Section 5 examined the Yellowstone River from the confluence of the Powder River, downstream to the North Dakota state line. Questionnaires were administered at popular recreation sites on the river to determine types of use and user background information. The study was conducted, in part, due to speculation that coal energy development in the lower Yellowstone River region would require large amounts of water from the river.

Glendive and Sidney are the two largest cities in Section 5 of the 1977 Yellowstone Impact Study. About one-half of the users surveyed in 1975-76 in Section 5 indicated that fishing was the primary recreational activity. Of those respondents, about 30 percent indicated that walleye and sauger were the principal species sought by fishermen; between 30 and 50 percent sought paddlefish; and about 20 percent sought catfish. More than half of the respondents surveyed were local residents and day users. More than one-

half of the respondents thought crowding was not a problem with their enjoyment of the recreational access sites and that more site development was desirable. Observations by DFWP personnel indicated that users in river Section 5 engaged in fishing, rest and relaxation, boating, canoeing, rock collecting, and sight-seeing. Table 9. of the report, *Relative Importance of Each Section to Popular Recreational Activities* indicated that rock-hounding was ranked first, followed by fishing, outdoor games, boating and floating, water-skiing, rest and relaxation, and picnicking.

A boating mail survey included in the same report in Table 14 indicated that of the 15 counties surveyed, Richland County boaters had the third highest boater days per year behind Dawson and Yellowstone counties. The findings were most likely related to the population of Yellowstone County, which includes the City of Billings, and the location of the Intake Dam fishing and boating access site in Dawson County. The study concluded that a reduction in streamflow would have a negative impact on hunting, fishing, boating, and swimming. Land-based recreation, the report concluded, would not be impacted by streamflow reductions.

In 1995, the Montana DFWP increased the size and services offered at the Intake Dam Fishing Access Site, located about 25 miles upstream of Crane, due to increased use and demands from constituents to improve the site. The EA for the Intake site project states that the Intake river reach, which extends into Richland County, supported about 19,172 angler days in 1991 (DFWP 1995). The site improvement project improved access roads, parking, camping facilities, and the boat ramp.

The boat ramp was widened to accommodate two vehicles simultaneously. The EA states: *The proposed site plan is intended to reduce congestion at the boat ramp area.* The Intake site, located in Dawson County, is subject to extremely high use annually, during the paddlefishing season. Most paddlefishing is done from the shore or from anchored boats since the paddlefish are concentrated below Intake Dam. However, the improved boat ramp has most likely increased boating traffic to some degree in the vicinity of the WCSIP diversion on the Yellowstone near Crane. The Intake project illustrates the popularity and increasing use of the lower Yellowstone River by boaters.

In 1997, an access site that serves as a take-out for boaters was developed at the State Highway 200 Sidney Bridge location. The take-out site makes use of the river much easier for residents of the Sidney area and use by the boating public has increased markedly since the bridge site development. In the last several years there has been an increase in use of jet-skis and jet-boats on the lower Yellowstone River, the extent of which has not been documented. Rock-hounding for agates continues to gain in popularity as well as deer and pheasant hunting (DFWP 1999).

## Gartside Reservoir

Gartside Reservoir is a 41-acre, stream and spring-fed reservoir that holds 326 acre-feet of water behind an earthen dam, 31 feet in height (HKM 1991). The reservoir is located just south of the town of Crane, and a short distance west of State Highway 16. The reservoir and picnic facility is owned and operated by DFWP, and offers rest rooms and two picnic table shelters with a number of cooking grills. The reservoir is an extremely popular summer recreation site used primarily by residents of nearby Sidney for swimming, shore-fishing, and picnicking. DWFP (1995) estimated that the annual angling days at Gartside Reservoir from March 1995 to February 1996 was 3,092. In fall, state land surrounding the reservoir is popular with pheasant hunters.

The reservoir is fed by Crane Creek, not far from where the creek exits the WCSIP site. In summer, when Crane Creek ceases to flow, the reservoir becomes, essentially, a spring-fed pond. The pond's crystal clear waters make it the most desirable swimming site in the Sidney area. DFWP plans to install improvements for the reservoir recreation facility in 1999, including a boat ramp and additional picnic accommodations.

# 4.0 - ENVIRONMENTAL CONSEQUENCES

This chapter is organized by resource area in the same order as presented in Chapter 3.0, with the probable consequences of the four alternatives described for each resources area.

## 4.1 Land Use and Vegetation

### Vegetation

A moderate direct impact to vegetation would occur under all of the action alternatives as a result of the conversion of about 760 acres of rangeland to irrigated cropland. Some range vegetation also would be temporarily lost along pipeline and power line routes, and where substations are located. Although most project pipelines and power transmission lines would follow existing road rights-of-way, some would cross cropland and rangeland. Disturbed areas along pipeline routes, booster stations, roads, substations, and transmission lines could become infested with weeds if not promptly reclaimed and seeded, preferably with native grasses. It is likely that herbicides would be used to control weeds. If care were not taken when applying the herbicides, native, non-target plants could be killed. These impacts would be minor to moderate under all of the action alternatives and would not occur under the No Action Alternative.

### Sensitive Plants

A search of the Montana Natural Heritage Program data base indicates that the prairie aster (Solidago Ptarmicoides) has been found on land immediately adjacent to the southeastern portion of the project. Although most of the land that would be irrigated in this vicinity is cropped, some rangeland would be disturbed under the four action alternatives and it is possible that prairie aster plants could be destroyed.

The nine-anther prairie clover (Dalea Enneandra) has been found near Fox Creek, in the northern portion of the project area. Again, most of the land that is proposed to be irrigated in this vicinity is already cropped, but there is some potential that these plants could be destroyed where rangeland is developed or along pipeline routes.

### Land Use

With irrigation, cropping would change from primarily small grains under a crop-fallow rotation to sugar beets grown in rotation with wheat, corn, alfalfa hay, and possibly other crops, such as seed potatoes, onions, carrots and peas. Because most of the land to be irrigated is already cropped, the impacts of this conversion to irrigation on land use would be minor under the four action alternatives.

Required land preparation identified by the applicant includes breaking-out the acres that are not cultivated, moving fences, bridging the bottoms of coulees with dikes to provide center-pivot wheel tracks, and establishing grassed waterways in the bottoms of small channels that drain some fields. The impacts associated with land-breaking would be moderate. The impact of other land preparation activities would be minor under all action alternatives.

In some instances, pivot locations may need to be adjusted slightly to avoid farm yards and buildings.

Some sections of pipeline and transmission line routes would cross lands owned by individuals who may not benefit from the proposed project. Easements would be required in those instances.

### Power transmission lines

Single-phase power lines exist throughout the project area. However, the three-phase electrical distribution system that would be necessary for the project does not exist. Because the applicant proposed to run most of the new utility lines along existing road routes, the impacts to land use under the four action alternatives are anticipated to be minor. The applicant indicated that one or more electrical substations would be

needed for the project. The location of these substations has not been proposed and, therefore, the associated impacts to land use cannot be assessed.

### Highways, Railroads, Canals

The project would require pipelines to be bored under two state highways. This would require an encroachment permit from the Montana Department of Transportation under the four action alternatives. The boring for the pipelines is not expected to delay traffic on the state highways.

The main supply pipeline for the WCSIP would be bored under the Lower Yellowstone Irrigation District supply canal. The canal and adjoining right-of-way is owned by the U.S. Bureau of Reclamation. If the boring is done to the specifications of the U.S. Bureau of Reclamation, the impact to the operations of the canal would be minor under the four action alternatives.

The project would require pipelines to be bored under the Burlington Northern Santa Fe Railroad. This would require an authorization from Burlington Northern Santa Fe under the four action alternatives. The boring for the pipelines is not expected to delay rail traffic.

### Transportation

Much of the WCSIP could be serviced using the existing rural road network. Short-term transportation delays probably would occur during project construction under all of the action alternatives. In the long-term, traffic on these roads would increase, due to the more intensive maintenance required of irrigated, as opposed to dryland agriculture. However, traffic on the rural roads would remain relatively light.

Portions of the proposed project area have no existing road access, while others have only primitive roads or two-track trails. In these instances, all-weather access road may need to be constructed. Approximately 4 miles of road would be needed to provide all-weather access the 400 series pipeline, pump booster station, and pivots. This may also require the construction of a crossing on Fox Creek. An access road may also be required along the pipeline/power line route that would service the 500 series of pivots, although the pivots would be accessible via existing roads. Construction of other short roads may be required to provide access to other pivots and booster station No.10. An access road may be required along the right-of-way of the main supply canal, but this has not been specified in the feasibility study submitted by the applicants. Given that a comprehensive road network already exists in the project area, the impact of adding new roads for land use access would be minor under all of the action alternatives.

## 4.2 Wetlands

### Impacts

Wetlands could be affected by the WCSIP in several ways under the four action alternatives. The greatest impacts would occur where the wetland is not farmed currently. In these cases, wetland soils may be plowed and mixed, and wetland grasses and forbes would be replaced by crops. Impacts to cropped wetlands would be less and, depending on irrigation water management, these wetlands could either expand or shrink. Pipeline routes would pass through wetlands, as identified in Table 3.2-2. Wetland vegetation and soils would be disrupted during excavation, but restoration may be possible through reclamation. To prevent trench and bedding materials from acting as a subsurface drains where pipelines and power lines cross wetlands, cutoff collars should be installed.

Under the Swamp-buster provisions of the Food, Agriculture, Conservation and Trade Act of 1990, farmers who convert wetlands to agricultural fields through draining, dredging, leveling, or filling can be denied federal farm benefits and payments. However, normal tillage, planting, and harvesting operations are permissible. The applicant has not submitted any plans to fill or drain wetland areas, although reference has been made in the feasibility study to bridging some small coulees with dikes to accommodate center pivot wheel tracks.

Wetlands also could fall under the jurisdiction of the COE under Section 404 of the Clean Water Act. This would generally prohibit dredge or fill in any wetlands that were not converted to cropland prior to December 23, 1985, unless appropriate restoration or mitigation measures were undertaken. Because the wetland analysis conducted in this EA is preliminary, consultation with the NRCS and possibly the COE, as well as an on-site wetland analyses, would be required prior to any drainage or fill work.

Overall impact of the WCSIP on wetlands is likely to be moderate under the four action alternatives. Some seasonal wetlands that are currently in pasture may be cropped as a result of the project. In other instances, it may be desirable to farm around potholes or leave small stream channels as grassed waterways. It is uncertain whether irrigation would cause pothole type wetlands to shrink or expand. Although the total acreage of wetlands that could potentially be impacted is relatively small, these small, scattered wetlands provide scarce habitat in an intensively cropped area. Simply farming around the wetlands could mitigate many potential wetland impacts. No impacts to wetlands would occur under the No Action Alternative.

## 4.3 Water Resources

### Surface Water

The WCSIP would pump water from the Yellowstone River at a maximum rate of 132 cubic feet per second (cfs). Although project irrigation demands may be highest during July, the relative effects of the diversions on river flows would be greatest during August, when flows drop to near seasonal lows and irrigation demands can still be high. Impacts would be the same under the four action alternatives. No impacts would occur under the No Action Alternative.

In Table 4.3-1, irrigation diversions of 132 cfs have been subtracted from the streamflows for the Yellowstone River near Sidney gauge that were summarized in Table 3.3-1. In Table 4.3-2, the proposed irrigation diversion rate of 132 cfs was divided by the Table 3.3-1 flows, and the resulting value multiplied by 100 to estimate percentage reductions to Yellowstone River flows that may result due to pumping by the WCSIP. This analysis indicated that during August of average years, the project would divert about 2 percent of the flow of the river. During a dry August (Q10 or driest year in ten), the project could divert up to about 4 percent of the flow of the river. Overall, the impacts would be minor except during very dry conditions when the project could use up to about 8 percent of the flow of the Yellowstone River and impacts would be moderate.

Table 4.3-1. Estimated Monthly Average and Percentile Streamflows During the Irrigation Season in cfs after Subtracting 132 cfs for WCSIP Irrigation Depletion.

| Percentile | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|
| Average | 9,570 | 17,199 | 36,214 | 21,463 | 7,556 | 6,757 | 7,957 |
| Q10 | 14,741 | 23,539 | 54,225 | 36,400 | 13,339 | 10,876 | 11,039 |
| Q20 | 12,378 | 20,509 | 49,111 | 31,184 | 10,451 | 8,621 | 9,979 |
| Q50 | 8,674 | 17,242 | 35,715 | 19,676 | 7,066 | 6,258 | 7,336 |
| Q80 | 6,782 | 12,586 | 23,968 | 11,295 | 4,598 | 3,929 | 5,825 |
| Q90 | 5,855 | 10,274 | 17,435 | 5,595 | 3,308 | 3,182 | 5,092 |
| Highest | 23,398 | 34,468 | 67,558 | 49,578 | 16,113 | 15,868 | 15,275 |
| Lowest | 2,689 | 5,277 | 12,100 | 3,551 | 1,470 | 2,257 | 4,078 |

Table 4.3-2. Percent Reductions to Monthly Average and Percentile Streamflows During the Irrigation Season Due to 132 cfs WCSIP Irrigation Depletion.

| Percentile | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|
| During Average Flows | 1.3 | 0.7 | 0.4 | 0.6 | 1.7 | 1.9 | 1.6 |
| Q10 | 0.9 | 0.5 | 0.2 | 0.4 | 1.0 | 1.2 | 1.2 |
| Q20 | 1.0 | 0.6 | 0.3 | 0.4 | 1.2 | 1.5 | 1.3 |
| Q50 | 1.5 | 0.7 | 0.4 | 0.7 | 1.8 | 2.0 | 1.7 |
| Q80 | 1.9 | 1.0 | 0.5 | 1.1 | 2.7 | 3.2 | 2.2 |
| Q90 | 2.2 | 1.2 | 0.7 | 2.3 | 3.8 | 3.9 | 2.5 |
| During Highest Flows | 0.5 | 0.4 | 0.2 | 0.3 | 0.8 | 0.8 | 0.8 |
| During Lowest Flows | 4.6 | 2.4 | 1.1 | 3.5 | 8.1 | 5.4 | 3.1 |

Irrigation withdrawals would also reduce the water level (stage) of the Yellowstone River but, because of the configuration of the Yellowstone River channel, the reductions to stage would vary from location-to-location. To give an example of how pumping by the WCSIP may affect water levels, estimated changes in stage at the USGS gauge at the Highway 200 bridge, near Sidney, where a relationship between river stage and flow has been developed, were analyzed. The estimated stage reductions due to pumping 132 cfs are summarized in Table 4.3-3. Decreases in stage would be greatest when streamflow is lowest and a greater proportion of the flow is being diverted by the project. River stage could be reduced by about .08 feet (about 1 inch) during a dry August. Overall impacts to river stage would be minor under the four action alternatives.

Table 4.3-3. Estimated Changes in River Stage at Yellowstone River Near Sidney Due to 132 cfs WCSIP Irrigation Depletions (feet).

| Percentile | Apr | May | Jun | Jul | Aug | Sep | Oct |
|---|---|---|---|---|---|---|---|
| During Average Flows | 0.04 | 0.03 | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 |
| Q10 | 0.03 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 |
| Q20 | 0.04 | 0.03 | 0.02 | 0.02 | 0.03 | 0.04 | 0.03 |
| Q50 | 0.04 | 0.03 | 0.02 | 0.02 | 0.04 | 0.05 | 0.04 |
| Q80 | 0.04 | 0.03 | 0.02 | 0.04 | 0.05 | 0.05 | 0.04 |
| Q90 | 0.04 | 0.03 | 0.03 | 0.04 | 0.05 | 0.06 | 0.05 |
| During Highest Flows | 0.02 | 0.02 | 0.04 | 0.02 | 0.02 | 0.03 | 0.03 |
| During Lowest Flows | 0.06 | 0.05 | 0.03 | 0.05 | 0.08 | 0.06 | 0.05 |

Irrigation return flow, within the project area, could seep into small streams such as Crane Creek, Fox Creek and Sears Creek, and their tributaries, thereby increasing the base flow of these streams. A drainage system was installed by DFWP to lower water levels in a hay field (sometimes cropped) adjacent to Crane Creek at the head of Gartside Reservoir. The system may no longer be adequate to provide adequate drainage for the hay field, if flow in Crane Creek increases as a result of return flows from the WCSIP.

## Water Quality

Water quality impacts by the WCSIP would occur if: (1) changes to the water quality of the Yellowstone River, or local ephemeral tributaries, occur as result of the project; or (2) irrigation with Yellowstone River water results in damage to soil productivity or the contamination of underlying groundwater aquifers. This section will discuss the first type of impact: potential changes to water quality in the Yellowstone River and its tributaries. Effects on soil productivity and aquifers are discussed in the *Soils* and *Groundwater Impact* sections. No impacts to water quality would occur under the *No Action Alternative*.

### *Total Suspended Sediment*

During construction of the water diversion system for the project, there would be short-term increases in total suspended sediment (TSS) in the Yellowstone River. This type of impact would be most noticeable under the *Infiltration Gallery Alternative* (Alternative 4), where local TSS concentrations in the Yellowstone River would increase noticeably during the short-term due to bank stabilization work, dredging and filling during coffer dam construction, and in the construction area de-watered by the coffer dam. Dredging and dewatering under Alternative 4 also could cause a short-term reduction in localized DO concentrations if anoxic organic materials are present in the dredged riverbed sediments. Also under *Alternative 4*, moderate short-term local increases in TSS could be expected each time the infiltration gallery is back flushed. If the backflushing were to result in a regular exceedence of the turbidity standard, a Montana Pollutant Discharge Elimination System (MPDES) permit may be required for this activity.

Under Alternatives 2, 4, and 5 there would be moderate, short-term increases in local Yellowstone River TSS during construction of the pumping station and the related bank stabilization components. However, the total amount of sediment that would be added to the Yellowstone River during construction would be small in comparison to the annual sediment load of the river.

Long-term impacts of the project on suspended sediment concentrations in the Yellowstone River would be minor under all alternatives.

There would be some moderate, short-term increases in suspended sediment concentrations in tributary streams during construction of pipeline and road crossings, which could be minimized by constructing the crossings when streamflows are low, such as during the late summer or fall. Because some of the clayey soils in the project area have low infiltration rates (see soils section), applying water at relatively high rates could result in surface runoff. There is a potential for moderate impact from surface runoff, which would be relatively high in TSS and could reach streams such as Fox Creek and Crane Creek. The surface runoff could also contain nutrients such as phosphorous and nitrogen. These impacts would be the same under the four action alternatives.

### *Total Dissolved Solids*

It is unlikely that substantial irrigation return flow from WCSIP would ever reach the Yellowstone River. Therefore, the effects of the project on the chemical quality of the Yellowstone river are expected to be minor under the four action alternatives.

Irrigation return flow from the WCSIP could be expected to have total dissolved solids (TDS) concentrations that are higher than the applied water. Under all of the action alternatives, there is a moderate potential that return flow would occur in sufficient quantities to have a noticeable impact on TDS and associated nutrient concentrations in smaller streams in the project area. This type of impact would be of special concern for Fox Creek, where the existing water quality is relatively good, and for Crane Creek,

because it supplies water to Gartside Reservoir, a popular recreation area. Further discussion of the potential for TDS impact can be found in the soils and groundwater sections of this EA.

### *Temperature and Dissolved Oxygen*

Streamflow reductions due to project pumping could cause some minor and indirect impacts to water temperature and dissolved oxygen (DO) in the Yellowstone River under all of the action alternatives. Reducing flows could result in a slight increase in water temperature during times when the flow of the river is very low. Related small decreases in DO also could occur, since warmer water can hold less DO.

### *Arsenic*

Arsenic concentrations in the Yellowstone River should not be affected substantially by the WCSIP under any of the action alternatives. Return flow from the project that would reach the Yellowstone River is expected to be minimal and much of the arsenic in the irrigation water would likely be assimilated by the soil (see soils section). There is a potential for some arsenic to reach tributary streams in the project area through irrigation return flow under all of the action alternatives.

No impacts to water quality would occur under the *No Action Alternative*.

## Stream Channel Form

As shown in Figure 3.3-1, the Yellowstone River is actively eroding its west streambank at the diversion site proposed for the WCSIP. Under alternatives 2 and 4, stabilizing the diversion-site bank with rock rip-rap is included. This may temporarily stop the bank from eroding at the immediate diversion site, but bank erosion above and below the stabilized area may still occur, or even increase, as a result. With time, upstream or downstream erosion could outflank and undermine the rip-rap zone unless refusal entrenchments are placed into the riverbank at the upstream and downstream ends of the zone.

The bendway weirs included Under Alternative 5, if successful, would stabilize the entire Yellowstone River meander in the vicinity of the proposed pumping station. The weirs should direct the flow away from the riverbank and towards the center of the channel. They also could dissipate some of the stream energy that is eroding the west bank of the river. The bendway weirs could be damaged during high flows or by ice and would therefore require maintenance. By restricting the natural migration of the river in the vicinity of the proposed pump site, the bedway weirs would have a moderate local impact on stream channel form. It is possible that the weirs could cause the river to scour the opposite shore and widen somewhat. The weirs also could cause the river channel to adjust upstream or downstream, but these effects are expected to be minor.

Stabilizing the riverbank, as proposed under alternatives 2, 4, and 5 would constrict the movement of the Yellowstone River. The resulting local impact would be moderate. The impact on the Yellowstone River as a whole would be minor because the stabilized area would constitute only a small fraction of the total length of the river. It is important to note that high flows in the Yellowstone River and associated flooding during recent years have focused attention on channel erosion and corresponding efforts to stabilize eroding riverbanks. The U.S. Fish and Wildlife Service has expressed concerns regarding the "cumulative" effects that the many bank stabilization projects on the Yellowstone River may be having on fish and wildlife habitat. Due to these factors, proposals to stabilize Yellowstone River banks--such as that by the WCSIP,LLC--are likely to receive careful scrutiny by the COE and U.S. Fish and Wildlife Service.

Impacts would be minor under Alternative 3 because it does not include bank stabilization. No impacts would occur under the No Action Alternative.

The bed of the Yellowstone River can also move vertically by scouring or agrading. Scouring by the river could erode the gravel pack and pipe of the infiltration gallery (Alternative 4) if it were not buried deep enough in the river bed. If the river agraded and sediment buried the infiltration gallery gravel pack, the permeability of the gallery would be reduced and less water would seep into it.

Flow reductions can lead to indirect adverse affects to stream channel form, such as vegetation encroachment and channel narrowing. However, it is unlikely that the flow reductions caused by the WCSIP, which would be small relative to high flow, would have a noticeable effect on the channel of the Yellowstone River, under any of the alternatives.

## 4.4 Ground Water

The leaching of agricultural chemicals (pesticides and fertilizers) would potentially affect ground water resources in the saturated portion of the SHU. The degree to which ground water would be affected by the proposed project depends on the depth to ground water, permeability of the soils and aquifer materials, irrigation and agricultural chemical management practices, and the chemical characteristics of the pesticides and fertilizers used. It is assumed that the potential ground water impacts would be the same for each of the proposed action alternatives.

The unconsolidated alluvial and terrace deposits represent important recharge areas and make aquifers within and below these deposits sensitive to sources of contamination. Once intercepted by the water table, contaminants will follow local flow paths and may either move downward to deeper parts of the aquifer, or discharge to surface water resources through springs or the gaining reaches of Fox and Crane creeks and their tributataries. Domestic and/or stock wells may be impacted if they intercept a contaminant flow path.

Pesticides expected to be used by the project producers are listed on Table 4.4-1. Most of these pesticides are specific to sugar beets and would only be used during times when that crop is grown. Dual and Post may be used if corn is grown as a rotation crop for silage or grain. Several of the pesticides are commonly used when growing small grain crops andare probably already being used under current farming practices. Eight of the chemicals listed in Table 4.4-1have moderate to very high leaching potentials. These eight chemicals have the highest potential of impacting the ground water resource. To minimize potential negative impacts, producers will have to carefully manage their irrigation and chemical application practices. Over application of pesticides and fertilizers will increase the potential for these chemicals to impact ground water. The potential will be greatest in areas with highly permeable soils and a shallow water table. Application of irrigation water in excess of soil infiltration rates will promote the loss of agricultural chemicals through runoff, which may in turn, impact nearby surface water resources.

Table 4.4-1. Pesticide Leaching potentials

| Pesticide Common Name | Pesticide's Active ingredient | ($T_{1/2}$) Half-life (in days) | ($K_{oc}$) Sorption Coefficient | (S) Solubility (in ppm) | (GUS)* Ground Water Ubiquity Score | Leaching Potential |
|---|---|---|---|---|---|---|
| Betamix* | Desmedipham, Phenmedipham | 30 | 1500 | 8 | 1.22 | Low |
| Betanex* | Desmedipham | 30 | 1500 | 8 | 1.22 | Low |
| UpBeet* | Triflusulfuron methyl | 14 | 64 | 3 @ pH 5<br>110 @ pH 7<br>11,000 @ pH 9 | 2.5 | Moderate |
| Nortron* | Ethofumesate | 30 | 340 | 50 | 2.17 | Moderate |
| Ro-Neet* | Cycloate | 30 | 430 | 95 | 2.02 | Moderate |
| Super Tin* | Triphenyltin hydroxide | 75 | 23,000 | 1 | -0.68 | Extremely Low |
| Benlate* | Benomyl | 67 | 1,900 | 1 | 1.32 | Low |
| Lorsban* | Chlorpyrifos | 30 | 6,070 | 0.4 | 0.32 | Very Low |
| Counter* | Terbufos | 5 | 500 | 5 | 0.91 | Very Low |
| Dyfonate* | Fonofos | 40 | 870 | 16.9 | 1.70 | Low |
| Dual** | Metolachlor | 90 | 1,200 | 530 | 3.32 | High |
| Poast** | Sethoxydim | 5 | 100 | 4,390 | 1.40 | Low |
| Banvil*** | Dicamba | 14 | 2 | 400,000 | 4.24 | Very High |
| Curtail*** | Clopyralid | 40 | 6 | 300,000 | 5.16 | Very High |
| Amber*** | Triasulfuron | 114 | 105 | 32 @ pH 5<br>815@ pH 7<br>1350@ pH 9 | 4.07 | Very High |
| 2,4-D*** | Acid<br>Demethylamine salt<br>Ester or oil soluble amine | 10<br>10<br>10 | 20<br>20<br>100 | 890<br>796,000<br>100 | 2.70<br>2.70<br>2.70 | Moderate<br>Moderate<br>Moderate |

Notes:

1. GUS Values are calculated using the soil half-life and the sorption coefficient
2. Sorption Coefficient is unitless value
3. ppm = parts per million

* Pesticides that may be used with sugar beet crops

** Pesticides that may be used with corn crops

*** Pesticides that may be used with grain crops

Source: Montana Dept. of Agriculture 1998.

## 4.5 Effects on Soils

### Soils Impacts Due to Irrigation

The degree to which soils are affected by irrigation depends upon existing land use, soil type, and irrigation management practices. For instance, irrigating dry cropland has much different effects on soils than irrigation of native rangeland. In Richland County only six of the twenty soil mapping units listed on Table 3.5-1 are currently used for irrigated agriculture. It is not possible to accurately assess all of the potential soil impacts resulting from the WCSIP using the available soil information. Additional, site-specific soil investigations should be required, prior to project construction, to adequately define soil characteristics for use in a detailed analysis of potential impacts to soils and for the development of mitigation measures. It is assumed that the potential soil impacts will be the same for each proposed action alternative. Potential impacts related to irrigation of the proposed project soils include wind and water erosion, soil salinity buildup, and development of saline seeps.

### Erosion

Soil erosion by both wind and water are potential concerns within the project area. Under current dryland farming and range conditions the majority (by area) of the project soils present only slight to moderate erosion hazards. However, as shown on Table 3.5-1 approximately 1,660 acres (13.9%) of the proposed project area contain soils that are classified as highly erodable by the Natural Resources Conservation Service (NRCS) office in Sidney, Montana.

Winds strong enough to cause some erosion occur almost every month. Winds are generally stronger and more frequent in the spring when winds average more than 20 miles per hour about 15 percent of the time. Wind speeds of 50 miles per hour or more are occasionally part of weather systems crossing Montana in fall and winter. Strong winds may also accompany thunderstorms during the summer. Three of the soil mapping units listed on Table 3.5-1 are classified as being highly susceptible to wind erosion. These three soils cover approximately 155 acres of the project area.

Irrigation of the project soils should decrease wind erosion rates during the irrigation season on cultivated fields because wet soils are more resistant to erosion. In addition, irrigation enhances crop cover during the growing season and provides more protection from wind erosion than dryland crops.

As currently designed, the center pivot system will use low-pressure sprinklers outfitted with rotators. A designed consideration associated with this type of system is the reduced radius of throw of the sprinkler head. This reduction significantly increases the instantaneous application rate due to the shorter application time that each point in the field receives. For typical low-pressure systems, instantaneous application rates may exceed 5 inches/hour towards the outer end of the lateral (Broner, 1995). Soils within the project area have initial cylinder intake rates that vary from a minimum to 0.1 inches/hour to a maximum of 4.0 inches/hour. The typical midpoint value for these soils is approximately 1.0 inches/hour. Therefore, excessive runoff and erosion will be the main management consideration with the proposed system.

The potential for severe erosion problems to develop will be greatest on soils classified as highly erodable. Mitigation measures that can be used to reduce soil erosion include the use of booms on the last few spans of longer pivots to widen the area of application and lower the instantaneous application rate. Guns at the end of the laterals should not be used. Proper tillage practices to catch water at the point of where it hits the ground should also be used. Carefully planned and managed irrigation scheduling will help to minimize excess irrigation and water runoff. In addition, a detailed site-specific soil investigation, with a focus on infiltration rates, should be completed as part of the system design process.

## Salinity

Irrigation in the semi-arid climate of the project area can lead to an increase in soil salinity, which may have a profound effect on crop yield and on long-term soil productivity. Yield reductions occur when salt concentrations in the root zone accumulate to such an extent that the crop is no longer able to extract enough water from the soil profile. Salinity effects are closely analogous to those of drought as both result in water stress and reduced growth. The extent to which salts accumulate in the soil will depend upon the irrigation water quality, irrigation management, and the adequacy of drainage.

Soil salinity increases as water-soluble salts present in the irrigation water become concentrated in the soil profile. The salt concentration increases as the crop removes most of the applied water from the soil to meet its evapotranspiration demand (ET) but leaves most of the salt behind to concentrate in a shrinking volume of soil water. With each irrigation, more salt is added with the applied water. A portion of the added salt must be leached from the root zone before the concentration affects crop yield. Leaching is accomplished by applying sufficient water in excess of the ET demands so that a portion percolates through and below the entire root zone carrying with it a portion of the accumulated salts. Over a period of time, salt removal by leaching must equal or exceed the salt additions from the applied water to prevent salt building up to a damaging concentration. The amount of water, which must pass through the entire rooting depth in order to control salt build up is called the leaching requirement (LR). The amount of leaching required is dependent upon the irrigation water quality and the salinity tolerance of the crop grown.

To estimate the leaching requirement, both the salinity of the irrigation water (ECw) and the crop tolerance to soil salinity (ECe) must be known. The leaching requirement can then be estimated using the equation (Ayers & Westcot, 1985):

$$LR = ECw / (5(ECe)-ECw))$$

Where: LR = the minimum leaching requirement needed to control salts within the tolerance (ECe) of the crop as a percentage of total amount of applied water;

ECw = salinity of the applied irrigation water in dS/m; and

ECe = Average soil salinity tolerated by the crop in dS/m for an acceptable degree of yield loss.

As shown in Table 3.3-2 the medium and maximum salinity values for Yellowstone River water near Sidney are 0.76 dS/m and 1.24 dS/m respectively. According to Ayers & Westcot (1985), irrigation water with salinity values between 0.7 – 3.0 dS/m may result in slight to moderate soil salinity problems (Ayers & Westcot, 1985)..

To estimate the potential for deleterious levels of salt to build up in the root zone of the project soils, the leaching requirement for alfalfa and sugar beets was calculated. These crops were chosen because they may be grown at the WCSIP site and have different tolerances to soil salinity. Of the grain crops that may be grown at WCSIP site, barley is slightly more salt tolerant than sugar beets while wheat is slightly less. Corn is slightly less salt tolerant than alfalfa. For any particular crop, higher levels of soil salinity can be tolerated in exchange for a reduction in yield potential. When irrigating with water having a salinity (ECw) of less than 1.5 dS/m, Ayers & Westcot (1985) recommend using a soil salinity value (ECe) that corresponds to a 90 percent or better yield potential.

Alfalfa is moderately sensitive to soil salinity and along with corn is one of the least salt tolerant crops proposed to be grown at the project site. Alfalfa can tolerate a soil salinity (ECe) level of 3.4 dS/m with a 90% yield potential (Ayers & Westcot, 1985). Using the medium and maximum ECw values given in Table 3.3-2 the leaching requirements for alfalfa are 0.047 and 0.079 respectively. Thus, when irrigating alfalfa with water having a salinity value (ECw) of 0.76 dS/m at least 4.7% of the applied water must percolate past the root zone in order to meet the leaching requirement.

The WCSIP Feasibility Study (FS) report estimates an annual ET of 31.53 inches for alfalfa. The total depth of water required to meet both the crop demand (ET) and leaching requirement can be estimated from the equation (Ayers & Westcot, 1985):

$AW = ET / (1 - LR)$

Where: AW = depth of applied water (in/yr);

ET = total amount of crop water demand (in/yr); and

LR = leaching requirement.

Given the leaching requirement values of 0.047 and 0.079, the annual depth of water needed to supply both ET and leaching requirement of alfalfa are 33.1 inches and 34.2 inches respectively. Precipitation, irrigation or a combination of the two can meet this requirement.

During the growing season (April – October) an average of 11.74 inches of precipitation falls in Richland County (IRZ Consulting, 1998[a]). Of this, an average of 8.06 inches is available to the alfalfa crop (effective precipitation). An additional 20.53 inches of water will be applied during the growing season by the proposed irrigation system. As shown of Table 4.5-1, the combined depth of effective precipitation and applied water will leave an average annual potential deficit of approximately 4.5 inches to 5.6 inches. A portion of the deficit may be made up by the 2.13 inches of average annual precipitation that falls outside the growing season. If 100% of the remaining average annual precipitation infiltrates into the soil column and percolates past the root zone the deficit will be reduced to approximately 2.4 inches to 3.5 inches. As a result of not meeting the leaching requirement, salts will began to accumulate in the root zone and may potentially reach concentrations high enough to reduce soil productivity.

Sugar beets can tolerate soil salinity levels up to 8.7 dS/m with a 90% yield potential (Ayers & Westcot, 1985). Using the previously cited medium and maximum ECw values for the irrigation water, the leaching requirement values are 0.018 and 0.029 respectively. The WCSIP FS estimates an annual ET of 28.3 inches for sugar beets. Given the leaching requirement values, the total annual depth of water required to meet the ET and leaching requirement for sugar beets is 28.8 inches and 29.1 inches respectively. As with alfalfa, precipitation, irrigation or a combination of the two can be used to meet this requirement.

As shown of Table 4.5-1, the combined depth of effective precipitation and applied water will leave an average annual potential deficit of approximately 2.7 inches to 3.0 inches. A portion of the deficit may be made up by the 2.13 inches of average annual precipitation that falls outside the growing season. If 100% of the remaining average annual precipitation infiltrates into the soil column and percolates past the root zone the deficit will be reduced to approximately 0.5 inches to 0.8 inches. Although the deficit is small, the leaching requirement will not be met. As a result, salts will began to accumulate in the root zone and over time may potentially reach concentrations high enough to reduce soil productivity.

Table 4.5-1. Leaching Requirements for Selected Crops

| Alfalfa | | | |
|---|---|---|---|
| Case 1 LR= 0.047 | | Case 2 LR= 0.079 | |
| 33.1 inches | = Average annual depth of water required to meet ET and LR. | 34.2 inches | = Average annual depth of water required to meet ET and LR. |
| - 8.06 inches | = Average depth of effective precipitation (April - October). | - 8.06 inches | = Average depth of effective precipitation (April - October). |
| 25.04 inches | | 26.14 inches | |
| - 20.53 inches | = Average depth of applied water (April - October). | - 20.53 inches | = Average depth of applied water (April - October). |
| 4.51 inches | | 5.61 inches | |
| - 2.13 inches | = Average annual precipitation outside of growing season. | - 2.13 inches | = Average annual precipitation outside of growing season. |
| 2.38 inches | = Annual deficit in depth of water required to meet ET and LR. | 3.48 inches | = Annual deficit in depth of water required to meet ET and LR. |

| Sugar Beets | | | |
|---|---|---|---|
| Case 1 LR= 0.018 | | Case 2 LR= 0.029 | |
| 28.8 inches | = Average annual depth of water required to meet ET and LR. | 29.1 inches | = Average annual depth of water required to meet ET and LR. |
| - 7.40 inches | = Average depth of effective precipitation (April - October). | - 7.40 inches | = Average depth of effective precipitation (April - October). |
| 21.4 inches | | 21.7 inches | |
| - 18.75 inches | = Average depth of applied water (April - October). | - 18.75 inches | = Average depth of applied water (April - October). |
| 2.65 inches | | 2.95 inches | |
| - 2.13 inches | = Average annual precipitation outside of growing season. | - 2.13 inches | = Average annual precipitation outside of growing season. |
| 0.52 inches | = Annual deficit in depth of water required to meet ET and LR. | 0.82 inches | = Annual deficit in depth of water required to meet ET and LR. |

ET = evapotransporation
LR = crop leaching requirement

Salinity values of the Yellowstone River water are low enough that several years of irrigation without leaching will probably be required before salinity begins to impact the soil resource. As previously shown, the leaching requirements for the proposed crops are relatively small making soil salinity relatively easy to manage. As long as the salt concentrations do not exceed crop tolerance levels for extended or critical periods of time, the leaching requirement can be met at any time. Leaching can be done at each irrigation, each alternate irrigation, seasonally or at longer intervals as necessary. Normal inefficiencies in irrigation water application may be enough to accomplish leaching. Early season rainfall may also help to meet portion of the leaching requirement. Pre-planting or off-season irrigation may also be sufficient to accomplish leaching. Leaching at these times has the advantage of avoiding heavy water use during the crop season.

Although the leaching requirement for crops can be calculated the amount of leaching that is actually taking place in the field can only be estimated. Soil and crop monitoring should be employed by the project sponsors to determine the need for leaching. Since considerable variation may be expected from one cropping season to the next monitoring should stress long-term trend and changes in soil salinity.

In Richland County, the development of saline seeps is generally associated with crop-fallow rotation systems. Saline seeps may develop if groundwater recharge areas are left fallow for extended periods of time. By keeping recharge areas planted annually with high water use crops such as alfalfa, producers have been able to control the development and spread of saline seeps.

Within the project area, annual cropping and efficient use of irrigation water will be key elements is controlling the development of saline seeps. The potential for seeps to develop will increase if poor water management leads to over irrigation. The use of alfalfa in the crop rotation will help to dry up the soil profile and control the development of seeps.

Ground water monitoring wells could be installed prior to the initiation of irrigation in order to collect baseline data on groundwater salinity. By monitoring changes in ground water salinity over time, saline seep development could be predicted. Mitigation measures designed to prevent the development or growth of saline seeps could then be initiated before the seeps become a problem.

## Soils Impacts Due to Converting from Dryland Agriculture to Irrigated Agriculture

Several changes occur when dryland farming is replaced by irrigation. Wind erosion rates decrease during the irrigation season on cultivated fields because wet soils are more resistant to erosion. Irrigation enhances crop cover during the growing season and provides more protection from wind and water erosion than dryland crops. Irrigation also increases plant residues returned to the soil. Soil structure is improved, microbe populations benefit from the added food source, and nitrogen fertility is enhanced.

## Soils Impacts Due to Converting Rangeland to Irrigated Agriculture

Within the project area approximately 760 acres of rangeland will be converted to irrigated agriculture. The effects of converting rangeland to irrigation are quite different from those associated with converting cropland. Researchers have measured decreases in organic carbon of 25 to 60 percent as a result of cultivating rangeland, with total nitrogen decreases of 24 to 50 percent (Blank and Fosberg, 1989; Baur and Black, 1981; Campbell and Souster, 1982; Dormaar, 1979). Organic matter losses of 15 percent were measured by Lehane and Staple (1943) within the first 10 months after cultivation. Annual losses would be greatest after the first 20 years and would stabilize after the first 50 years (Doughty et al., 1954). These changes are likely to reduce the ability of soils to hold water, increase soil susceptibility to erosion, and increase the need for chemical fertilizers (Blank and Fosberg, 1989; Campbell and Souster, 1982).

The effects could be reduced somewhat if alfalfa is used in the crop rotation. Alfalfa, as a nitrogen fixing plant, increases the amount of nitrogen available to subsequent crops. The addition of alfalfa residues would lessen the loss of organic carbon. The perennial cover of an alfalfa crop would reduce erosion throughout the year and provide additional moisture by trapping snow. An alfalfa-grain rotation would disrupt weed and insect pest cycles established under dryland cropping patterns.

## Soils Impacts Due to Pipeline and Service Road Construction

Pipeline and service road construction can reduce agricultural production by compacting soil and mixing soil layers. Mixing topsoil with subsoil reduces organic matter and nutrients available to plants, increases stoniness, and leaves higher concentrations of salts near the surface (Mutrie and Wishart, 1987). Compaction crushes the structure of the topsoil and reduces porosity, creating an impenetrable layer, or hardpan.

Soil disturbances would be greatest for pipelines with a diameter greater than 18 inches. According to the West Crane Irrigation Project Feasibility Study (IRZ, 1998[a]), the proposed project would require the installation of approximately 141,350 ft of pipeline measuring 18 inches in diameter or greater. The pipeline would have a minimum cover of 36 inches of soil.

Adverse effects to soils can be minimized with proper procedures. To eliminate mixing, soil can be double-lifted during trenching. With this technique, the topsoil is excavated, stored, and replaced separate from the subsoil. During construction, either the entire right-of-way could be cleared or just one side, including the trench and soil storage area. If the working site is not cleared, deep ripping may still be necessary to correct compaction caused by heavy vehicle traffic. Retaining stubble and plants would also help prevent compaction.

Erosion of streambanks and steep slopes also would occur during and after pipeline construction. Soil erosion could be reduced with proper drainage, timely construction, and reclamation measures, techniques commonly used during pipeline construction. Proper drainage could be ensured by installing cross-ditch and berm structures, and sub-drains. Construction would be scheduled when streamflow is low and when the soil is dry to avoid rutting and compaction. Re-contouring streambanks and slopes to their original configuration, and planting native plants or cover crop species would decrease erosion. In highly erodable soil, mulch could be used to protect the soil until vegetation grows.

Soil productivity would be lost on land converted to service roads. Improperly constructed and maintained service roads could also be subjected to increased erosion. Service roads constructed adjacent to streams or drainages could lead to increased sediment loads in the waterways. These impacts could be reduced with proper road maintenance and installation of erosion control structures, such as berms.

## 4.6 Economic and Social Factors

### Population

#### *Effects of No Action*

As described in Chapter Three, the population of Richland County has declined steadily over the last two decades. Population projections over the next two decades suggest a modest increase in the population of Richland County. The county's population is projected to reach 10,200 by 2000; 10,540 by 2010; and 11,540 by 2025 (Montana Department of Commerce, undated). These projections represent an average annual rate of growth of 0.5 percent. During this period, the state's population is projected to reach 900,810 by 2000; 983,770 by 2010; 1,076,600 by 2020; and 1,125,540 by 2025 (Montana Department of Commerce, undated), or an average annual rate of growth of .9 percent.

#### *Effects of Project under the Four Action Alternatives*

The direct impact on the population of Richland County by the proposed project would be minimal. Direct full-time employment, generated by the construction and operation of the project, would be less than twenty during construction and less than five following construction (IRZ 1997). As a percentage of Richland County's population, the number of employees directly employed by the project is quite small. By increasing the viability of agricultural operations in the area, however, the proposed project may assist in retaining population in the project area. Project proponents claim that the project will indirectly generate over one hundred jobs in the area. Indirect employment generated by the project would retain population in the region and may stimulate population growth. It is not likely that new population generated by the project would strain existing community services.

### Employment and Income

#### *Effects of No Action*

If none of the alternatives proceed, a continuation of recent employment trends could be expected. These trends, as described in Chapter Three, include decreasing employment in farming, mining, transportation and public utilities, and government and increasing employment in agricultural services, construction, retail trade, and services.

#### *Effects of Project under the Four Action Alternatives*

Direct full-time employment generated by the construction and operation of the project would total no more than twenty jobs during construction, and fewer than five jobs following construction (IRZ 1997). These employment levels result in increases in income of approximately $420,000 for the period of construction, and up to $100,000, annually, for operation and maintenance of the project.

Estimates of indirect employment generated by a project rely upon assumptions regarding the proportion of inputs obtained from local sources and the further processing of outputs locally. Project proponents claim that the project will indirectly generate over one hundred jobs in the region. Because the amount of goods and services available locally is rather limited, a significant proportion of indirect employment impacts would be experienced in larger regional centers beyond Richland County and, quite possibly, outside of Montana. Some proponents suggest that the increase in irrigated acreage would attract food-processing activities to the area, which would result in significant stimulation to the local economy. The likelihood of such developments appears highly speculative at present. The increase in annual income associated with the creation of one hundred jobs is approximately $1.9 million.

## Taxation

### *Effects of No Action*

If none of the alternatives proceed, the taxable value of the proposed project acreage would remain unchanged, absent any changes in land use or tax policy.

### *Effects of Project under the Four Action Alternatives*

The proposed project would result in the reclassification of 11,112 acres of dryland acreage and 760 acres of rangeland to irrigated crop land. The reclassification of the project acreage would result in an increase in property tax revenue derived from project acreage of $70,863. In addition, property taxes on project equipment would increase property tax revenue and income tax revenue would increase from the increase in employment due to the project.

## Agricultural Sales

### *Effects of No Action*

If none of the alternatives proceed, agricultural sales from the proposed project acreage would be subject to future market and growing conditions for crops that are possible to raise without irrigation.

### *Effects of Project under the Four Action Alternatives*

The project consultant estimates that the value of annual agricultural production for the project would be $7.8 million. Estimated direct business activity generated by this level of agricultural sales would range between $3.9 million and $6.3 million, which would lead to gross economic outputs in the region of between $9.4 million and $15.0 million (IRZ 1998[a]). These estimates are based on the assumptions that, fifty and eighty percent of goods and services used in production, respectively, would be purchased in Montana. Given the project area's proximity to regional trading centers in North Dakota, it would appear that the portions of goods and services assumed to be purchased in Montana are rather high. Assuming that thirty percent of goods and services used for production are purchased in Montana, estimates of direct business activ and gross regional output are $2.3 million and $5.6 million, respectively.

# 4.7 Wildlife

Under the four action alternatives, actual project development (construction) will have a slight, short-term negative impact on resident pheasants and white-tailed deer. These impacts would be ameliorated if the actual construction was to occur in the fall (August-November) and/or early spring (mid March-mid April). This would avoid critical wintering periods (December-mid March) for wildlife and nesting, brood rearing periods for pheasant (mid April-July), and fawning for deer (May-June). No impacts to wildlife would occur under the No Action Alternative.

1. **Threatened and Endangered (T&E) species.** The bald eagle (threatened) is known to occur in the area to be impacted. The impacts of the project would be negligible as the period of area use by bald eagles (early spring, fall, winter) would fall outside the period when the project is in operation. Power poles for power transmission may have a slight impact on other raptors (primarily buteos) during the period when the line is energized. The impact centers around potential electrocution of raptors perching on power poles. Should this occur, those particular poles used as perches may need to be modified with devices that prevent electrocution or discourage perching. A discription of devices that can be used are summarized in a report by Oldendorff, Miller, and Layman (1981). It is unlikely that interior least terns would be affected by the proposed project because they have not been observed nesting this far downstream on the Yellowstone River (Bacon 1996). Piping plovers may migrate through the area, but probably would not be affected by the proposed project.

2. **Seven Sisters WMA.** The project would have minimal, temporary impact on wildlife using the WMA during the period of start-up in the spring. Start-up may temporarily displace wildlife until they become

accustomed to the activity, noise, and lights. The location of the project, to the north across the boundary slough from the WMA, will minimize impacts.

3. **Riparian Habitat.** Primary impacts would center around actual project construction and would be temporary and minimal. Timing of construction (fall and early spring = optimal times) would minimize these impacts. Actual project operation would have impacts similar to No. 2 above.

4. **Other impacts.** The end result of the project, converting dryland grain to irrigated crop would have positive, beneficial impacts on wildlife by increasing habitat diversity and habitat edge. The benefits to wildlife would be further increased if pivot "corners" where either seeded to grass/legume mix (for nesting, brood rearing, fawning) and left idle; or seeded to grain food plots and left standing for winter food and cover; or developed into wildlife windbreaks/shelterbelts. The proposal calls for converting some native grassland into irrigated crop (pivots 302, 303, 304, 305). Loss of any native grassland is a concern in this entire area and would reduce wildlife habitat diversity. This action would have a moderate impact in the immediate vicinity. As this piece is privately owned, conversion would up to the landowner's discretion.

## 4.8 Fisheries

### General Comments and Concerns

The potential impacts of the project on the endangered pallid sturgeon and other native fish species are of particular concern. The post-larval forms of the following fish would have the greatest chance of being affected by surface withdrawals: paddlefish, western silvery minnow, plains minnow, flathead chub. Fish eggs and larvae that would have the greatest chance of being impacted by bottom withdrawals include the pallid sturgeon, shovelnose sturgeon, paddlefish, channel catfish, burbot, sicklefin chub, sturgeon chub, blue sucker, sauger and walleye.

It has been found that larval pallid sturgeon showed a definite orientation to the upper water column for approximately eight days after hatching ( which generally occurs when water temperatures reach 20-22 °C). However, during the initial days of development, the lack of fin development will likely prevent the fish from maintaining a surface orientation as it drifts with the current (Krentz 1998). After the eighth day, larval pallid sturgeon began to "associate" with the bottom (Kynard.1998). Krentz's report (1998) indicates that pumps, which withdraw water from the bottom of deep-water areas (water greater than 2 meters deep), have a greater likelihood of entraining paddlefish and sturgeon eggs.

Based on these studies, irrigation projects on riverine habitats could minimize entrainment of fish larvae and eggs by using intakes that are situated near the surface over deep water (greater than 2 meters). Intakes that withdraw water from the bottom of the thalweg should be avoided to minimize impacts to native riverine fish species (Krentz.1998). Near surface intakes, above deep water sites would be less likely to entrain paddlefish and sturgeon eggs/larvae.

Based on the fish egg and larvae sizes described in Section 3.8, the mesh opening size of pump intake screens should not exceed 2.5 mm for eggs, and 5.0 mm for larvae.

#### *Alternative 1- No Action*

Potential effects to threatened and endangered fish species or species of special concern would not occur because no water would be diverted from Yellowstone River for this project.

#### *Alternative 2- Proposed Project*

A battery of 15 floating pumps with the capacity outlined in Chapter 2.0, with an unidentified screen mesh size, but size that would be sufficient to keep out trash and larger fish, would be of significant concern for the fishery. Fish species that have primary spawning site in immediate vicinity of water withdrawal intakes would be negatively impacted by entrainment of eggs at time when initially broadcast or when fish larvae are hatching.

Another component of this alternative that would adversely impact fish is the plans to stabilize approximately 450 feet of the riverbank with rock rip-rap. Bank stabilization would adversely alter the natural river habitat that is important to native species in the Yellowstone River.

In summary, this alternative could result in major impacts to fish and is not desirable from a fisheries viewpoint.

### *Alternative 3- Fine Screening of Intakes*

The use of a screening system with a maximum opening size of 2.5 mm (0.1 inches) appears to be adequate to address most concerns regarding the impingement and entrainment of larvae fish and eggs. The intake screens should be positioned as close to the surface as possible and over deep water (preferable greater than 2 meters deep), to reduce negative impact to most native fish species.

The biggest concern with this alternative, from a fisheries viewpoint, is that the screens are maintained so that they remain properly functional. A screen-monitoring plan with verification requirements should be developed to assure that the function and integrity of the screens is maintained.

### *Alternative 4- Infiltration Gallery*

This alternative would address concerns regarding fish entrainment and impingement. However, the excavation of such a large area of the riverbed during the initial installation would be very disruptive to fish in the short term. The sediment introduced into the water column and disruption of the substrate during system backflushing would impact fisheries, although these impacts are difficult to assess.

The impacts of the bank stabilization associated with this alternative are also of concern. These effects would be the same as discussed under Alternative 2.

Because the impacts to fisheries under this alternative are uncertain, it is recommended that further environmental review of this alternative be conducted if the applicants were to consider going forward with it.

### *Alternative 5 – Slotted HDPE Pipe with Bendway Weirs*

Although the slotted HDPE pipe screens would address concerns related to fish entrainment and impingement, the impacts of the bendway weirs on the fisheries are largely unknown. Because the weirs would effect 2,200 feet of riverbank, this alternative has the potential to cause the greatest impacts to fish habitat. There is the potential that significant impacts to resident fish could occur, given that substantial change in physical habitat and hydraulic conditions that would occur, and the length of the riverbank affected.

Because the impacts to fisheries under this alternative are uncertain, it is recommended that further environmental review of this alternative be conducted if the applicants were to consider going forward with it.

## 4.9 Cultural Resources

There is a high likelihood that cultural resources could be affected by the proposed project under all of the action alternatives. When construction plans are finalized for the WCSIP, and prior to construction activities, a Class III inventory of cultural resources will be conducted of the portions of the APE that the DNRC and COE deem necessary to inspect. Cultural resources surveys would probably be required where pipelines and powerline routes cross State lands, except when the routes are along disturbed areas such as road right-of-ways. To date, the COE has recommended that (1) pipeline routes be surveyed, except when located within a disturbed area such as a road right-of-way, (2) a sample survey be made of at least ten percent of the project lands, with the sampling concentrated on areas most likely to contain sites, such as undisturbed rangeland and terrace edges nearest to the Yellowstone River (COE, 1998), and (3) should sites be found, an evaluation of there potential for eligibility or nomination to the National

Register of Historic Places be conducted. Mitigation of adverse effects to NRHP- eligible sites will be agreeable to the DNRC on state lands and to the Corps of Engineers on all other lands within the APE.

## 4.10 Recreation

### Yellowstone River

A battery of 15 floating pumps spaced equally over 450 linear feet of river, as included in alternatives 2 and 3, would present an obstacle to the boating and floating public, including the use of canoes, drift boats, motor boats, rafts, jet-skis, and jet-boats. The intake pipes that extend from the floating raft to the shore can be extended up to 50 feet from shoreline into the river. Since the diversion river reach is located on an outside river bend, floating craft would have a tendency to move closer to the outside bend riverbank as they travel downstream.

Irrigation diversion structures are commonplace in Montana where lands adjacent to rivers are irrigated. Irrigation diversions are usually located on outside bends, since the incised, or deepest channel is located on the outside river bend, allowing diversion of water during periods of low flows when shorelines on inside bends recede. An environmental assessment of low-impact portable irrigation diversion structures used to divert water during periods of low stream flow in tributary streams of the upper Missouri River basin proposed the use of conspicuous signage to warn floaters and boaters of the approaching obstacle presented by the structures (U.S. Bureau of Reclamation, 1995). The proposed sign scheme for that project called for the installation and maintenance of two signs located upstream of the diversion structure site:

> *"The site review team will advise on sign placement considering the local conditions at the diversion site. Otherwise, the first sign should be placed 150 yards upstream of the diversion in a highly visible location indicating the distance to the diversion and the side of the river of its location. The second sign should be placed between 50 and 75 yards upstream of the diversion."*

The signage proposal for the diversion structures also proposed locating similar warning signs at DFWP fishing access locations upstream of the diversion sites and at any other local traditional put-in sites, such as road bridge crossings. The signage scheme for the portable diversion structures was found to be acceptable by a number of state and federal agencies as well as the public.

### Gartside Reservoir

Impacts of the WCSIP to Gartside Reservoir are limited, primarily, to the potential for water quality degradation. Such degradation could be caused by surface runoff of nutrients and sediments to Crane Creek, which feeds Gartside Reservoir, and migration of contaminants, such as herbicides and pesticides, moving toward the reservoir with groundwater return flow from project sites draining to the Crane Creek alluvial aquifer. As mentioned earlier, the exceptional water quality and clarity of the spring water feeding Gartside Reservoir contributes greatly to the quality of swimming, and to a lesser degree, fishing at the reservoir. It is difficult to quantify the aesthetic value provided by the water quality at Gartside Reservoir, but it is safe to say that this attribute makes it the most popular swimming destination for miles around.

# 5.0 – PREFERRED ALTERNATIVE AND RECOMMENDED MITIGATION MEASURES

## 5.1 Prefered Alternative

The environmentally preferred alternative is Alternative 3: *Fine Screening of Intakes*. This alternative is preferred because (1) The impingement and entrainment of fish--especially the endangered pallid sturgeon--would be minimized by using fine-meshed pump screens, and (2) it does not include bank stabilization measures and therefore, the river would be free to migrate, and existing river habitat that is used by native fish species would be preserved. A comparison of the impacts for the five alternatives can be found in table 5.1-1.

Alternative 4 (*Infiltration gallery*) and Alternative 5 (*Slotted HDPE pipe intake screens with bendway weirs*) would satisfy concerns regarding the entrainment and impingement of fish. However, the bank stabilization measures that are included in these alternatives would impact the morphology of the Yellowstone River channel and associated fish habitat. If the applicant pursues bank stabilization as part of the final project design, further review of these measures would likely be required when a Section 10, Rivers and Harbors Act permit is applied for through the COE.

## 5.2 Recommended Mitigation

### Fisheries

A pump screening system should be implemented by the WCSIP, LLC and should include the following criteria: (1) the maximum screen opening size should not exceed 0.1 inches, (2) screen intake velocities should not exceed 0.5 feet per second, (3) the screens should contain an internal baffling system that balances intake velocities over the screen area, (4) the screens should be positioned as close to the surface as possible and over deep water (at least 6 feet deep), and (5) A screen-monitoring plan with verification requirements should be developed to assure that the function and integrity of the screens is maintained.

### Water Quality

Irrigation return flows from the WCSIP could affect the quantity and quality of water in the Fox Creek, Crane Creek, and Sears Creek drainages. These creeks are listed on the Montana 303(d) list of water bodies in need of total maximum daily load (TMDL) development. Furthermore, Crane Creek flows into Gartside Reservoir, a popular local recreation area with good water quality. The WCSIP, LLC should work with the RCCD, DEQ and DNRC to develop a water quality protection plan that includes implementation of agricultural best management practices (BMPs). The BMPs should be designed to minimize non-point source pollution through land and irrigation water management practices. BMPs should follow guidelines presented in the State of Montana Nonpoint Source Management Plan (DEQ, 1991). Water quality monitoring should be an integral part of the plan. Baseline water quality data should be collected from the streams and Gartside Reservoir for comparison, periodically, with post-development samples.

An irrigation water management program would minimize off-site surface water runoff from project lands. This would reduce sediment and agricultural chemical transport to streams and Gartside Reservoir. The NRCS Office personnel in Sidney have been working with area irrigators for about ten years in the area of irrigation scheduling, using the North Dakota Agricultural Water Network remote automated weather stations, one of which is located in Montana, near Sidney. NRCS personnel also work directly with area producers in on-field consultation and have established a good working relationship. This successful collaboration should be fostered and used for the WCSIP. Expansion of the Montana AgriMet scientific irrigation scheduling program, a collaboration between the U.S. Bureau of Reclamation, conservation districts, and the NRCS, should be considered for the WCSIP.

### Recreation

An approach similar to the example cited in Section 4.1 should be implemented to warn floaters of hazards associated with the project pump site. A field review should be conducted at the WCSIP project site and the stream bank upstream for a distance of about one-quarter of a mile, to determine the most visible location of two warning signs to provide timely warning for floaters and boaters approaching the diversion site. The signs should be no smaller than 4 feet by 6 feet in size, positioned in a prominent location that is visible easily to boaters, white in background and red in lettering, attached to a self-supporting structure of posts no less in dimension than 4-inches by 4-inches, and at locations no less than 200 yards and 100 yards upstream from the first obstacle to be encountered by an approaching craft.

Additionally, signs warning river users of the WCSIP project diversion should be posted conspicuously at boat ramps at the DFWP's Intake Recreation Site and other popular river access points and recreation sites, subject to the review and approval of the DFWP and DNRC. One large warning sign should be located immediately adjacent to, or affixed to the most upstream floating pump unit. Maintenance of the warning signs should be the responsibility of the applicants, unless otherwise provided and assumed by DFWP.

## 5.3 Need for an EIS

DNRC believes this EA will be sufficient to comply with the MEPA and that an EIS will not be require if the WCSIP,LLC uses a floating pump intake system, and implements the mitigation measures outlined above. If the applicant were to pursue Alternative 4 (*infiltration gallery*) or Alternative 5 (*slotted HDPE pipe screens with bendway weirs*), further analysis may be required to assess the potential effects of these alternatives on the Yellowstone River channel and associated fish habitat. The appropriate timing for such analysis would probably be during application to the COE for a Federal Section 10, Rivers and Harbors Act Permit. A survey of cultural resources also will probably be required by the COE at that time (see Section 4.9).

**Table 5.1-1 West Crane Sprinkler Irrigation Project Impact Comparison Table**

| RESOURCE | ALTERNATIVE | | | | |
|---|---|---|---|---|---|
| | **No Action** | **Proposed Project** | **Fine Screening of Intakes** | **Infiltration Gallery** | **Slotted HDPE Pipe with Bendway Wiers** |
| **Land Use** | None | Moderate | Moderate | Moderate | Moderate |
| **Vegetation** | None | Moderate | Moderate | Moderate | Moderate |
| **Wetlands** | None | Minor - Moderate | Minor - Moderate | Minor - Moderate | Minor - Moderate |
| **Surface Water Flows** | None | Minor - Moderate | Minor - Moderate | Minor - Moderate | Minor - Moderate |
| **Water Quality** | None | Minor - Moderate | Minor - Moderate | Minor - Moderate | Minor - Moderate |
| **Stream Channel Form** | None | Moderate | Minor | Moderate | Moderate |
| **Ground Water** | None | Minor | Minor | Minor | Minor |
| **Soils** | None | Moderate – Potential for Severe on HEL | Moderate – Potential for Severe on HEL | Moderate – Potential for Severe on HEL | Moderate – Potential for Severe on HEL |
| **Economic and Social Factors** | None | Minor - Moderate | Minor – Moderate | Minor – Moderate | Minor - Moderate |
| **Wildlife** | None | Minor in Short term Moderate Beneficial in Long Term | Minor in Short term Moderate Beneficial in Long Term | Minor in Short term Moderate Beneficial in Long Term | Minor in Short term Moderate Beneficial in Long Term |
| **Fisheries** | None | Major | Minor | Unknown | Unknown |
| **Cultural Resources** | None | Unknown | Unknown | Unknown | Unknown |
| **Recreation** | None | Minor - Moderate | Minor - Moderate | Minor - Moderate | Minor - Moderate |

Notes: HEL = Highly Erodable Land

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